CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS
Ninth Annual Session, New York, October 21-26, 1918

ANNUAL SUBSCRIPTION: UNITED STATES AND CANADA, $10.00; FOREIGN, $12.00 (£2 10s.)

Volume XXVII | OCTOBER, 1918 | Number 4

Surgery, Gynecology and Obstetrics

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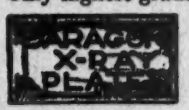

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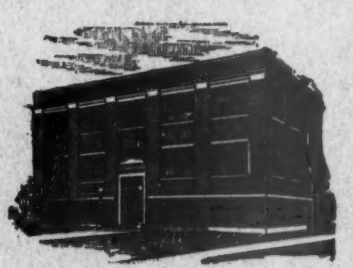

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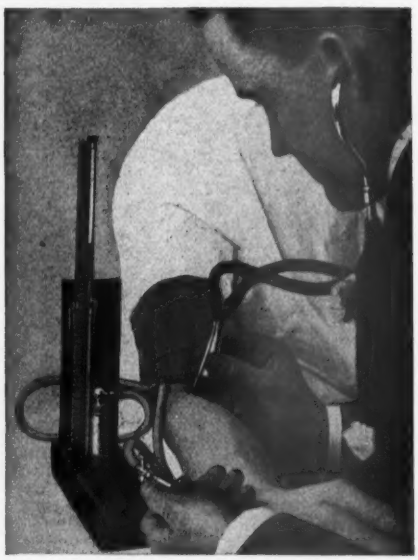

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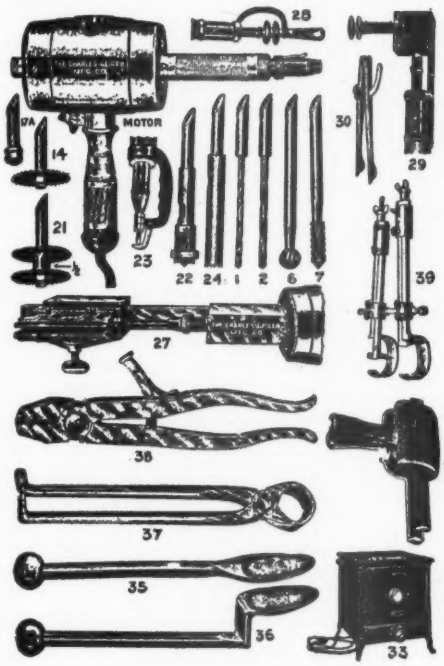

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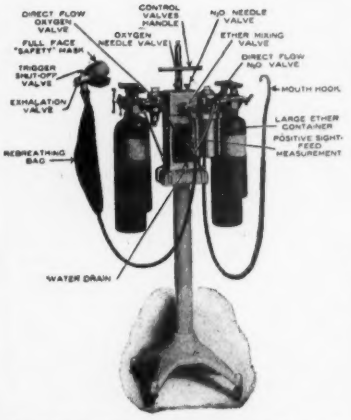

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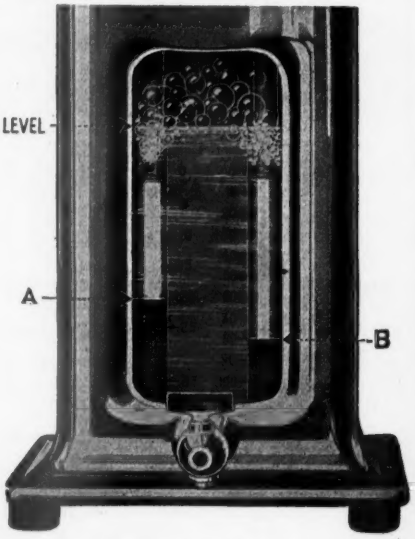

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VOLUME XXVII OCTOBER, 1918 NUMBER 4

THE REPAIR OF LARGE GAPS IN PERIPHERAL NERVES BY NEUROPLASTY[1]

BY KENNETH A. J. MACKENZIE, M.D., F.A.C.S., PORTLAND, OREGON

WHILE a great volume of scientific work has been done in the field of neurological surgery especially in the realm of the brain and spinal cord, relatively little has been done in the surgery of the peripheral nerves. This branch, however, looms very largely in the great war that is now raging in Europe, and countless thousands of injuries of the kind are taking place.

A wealth of experience in this, as in all branches of surgery, will doubtless bring about adjustment of many unsettled problems and throw a flood of light on such highly specialized branches as those of the nervous system. Observations of the reports made by many commentators in this field of surgery since the war began and during its progress, convinces one that up to the present time the main work has been to assemble the material and the practical experience. At a later period, after the strife is over, the material will be sifted and delivered to the world literature.

It is observed that, on the field and in the hospital, surgeons seem to adhere to more or less stereotyped methods of treatment in vogue in the past. There is even a disposition on the part of surgeons in high places to discard methods of treatment that have been proved to be successful. Thus the transplant, whether the auto-, the homo-, or the hetero-variety, is decried as useless and the method advocated in this study for selected cases is given no place at all. Experience, even in a very limited degree, which is the lot of most general surgeons who, after all, must deal with a great many of these cases, must be evaluated with the experience of any other group.

The object of this study is to present three cases which embody certain variant principles of treatment and in which very satisfactory results have been attained. In point of fact, under no other method of treatment known to the writer, could relief have been attained, and for that reason they possess a certain intrinsic value. The three cases submitted illustrate the utilization of nerve flaps of both central and peripheral origin in order to bridge unusually large gaps in peripheral nerves.

The first case is the outline of one presented to the American Surgical Association in Philadelphia, in June, 1909, the man having been brought to the scene of the meeting and exhibited.

G. E. C. developed in 1888 molluscum fibrosum, the tumors varying in size from a millet seed to a walnut, and disseminated over the trunk, head and extremities. In 1898 one of the tumors developed rapid growth in the right arm above the inner condyle of the humerus. After its removal local paralysis in the hand succeeded but passed away within six months. In May, 1907, a slight swelling was observed on the posterior mid region of the right thigh which was painful and sensitive. After a direct injury sustained in December the tumor developed rapid growth. The slightest pressure

[1] Read before the American Surgical Association, Cincinnati, June, 1918.

Fig. 1. Segment ten and three-quarter inches in length removed from sciatic nerve. (Case 1.)

over the tumor would cause the most intense local pain which was transmitted down the leg and diffused over the foot. The pain finally becoming unbearable, the patient was admitted to my service in St. Vincent's Hospital.

Examination revealed a tumor as large as a goose egg in the central part of the right thigh over the sciatic nerve. There was a paretic condition of the muscles of the leg and foot on the affected side and scattered areas of hyperæsthesia and anæsthesia. The diagnosis made at the time was metastatic tumor of the sciatic nerve.

The first operation was performed February 4, 1908. A median incision was made over the tumor from its upper to its lower limits. The tumor thus presented proved to be the sciatic nerve with abnormal contents. The surgical procedure had now to be quickly determined. Because of the rapid growth of the tumor, its tendency to infiltrate surrounding parts, the loss of outline of nerve structure, and the intense suffering, a complete resection of the sciatic nerve was decided upon. The upper section of the nerve was made at the lower border of the gluteus maximus and the lower about one inch below the apex of the popliteal space. Hæmorrhage was moderate. The anatomic parts were restored as carefully as possible. The wound was closed in layers with iodized catgut and it was found on the tenth day that union had taken place by first intention. The segment removed was 10¾ inches in length, and the diameter of its greatest part was about 3 inches (Fig. 1).

An exhaustive report of the pathology of the tumor was made by J. C. Bloodgood, of Baltimore, and was pronounced to be malignant, a spindle-celled sarcoma which originated in the perineurial connective tissue.

Examination of the leg showed that there was absolute paralysis of the entire musculature of the leg and that sensation was abolished except over the area of distribution of the anterior crural nerve. Nothing could have been worse than the appearance of the leg. It was of a dark purple color, greatly swollen and œdematous. Large blebs presented themselves over the entire involved area. The toes presented the appearance of threatened gangrene and the loss of the leg seemed imminent.

Realizing that the leg in its existing condition was useless and a menace, it was determined as the one feasible course to bridge the gap in the sciatic by making a flap from the internal popliteal nerve on the theory that thereby a path for the conduction of motor and sensory impulses could be established and, at the same time, provide a path for regeneration and avert the catastrophe of amputation. Accordingly on February 21, 1908, with the aid of student assistants in my surgical clinic, an incision thirty inches in length was made from a point midway between the tuberosity of the ischium and the great trochanter extending to a point behind the internal malleolus.

The central end of the sciatic was found retracted above the lower border of the gluteus maximus. The free ends of both popliteal nerves were next exposed and, as part of this operation, the end of the external branch was implanted and sutured into a cleft made on the lateral aspect of the internal popliteal, half an inch from its end. The internal popliteal nerve, which was still enlarged, was then traced by careful dissection to the inner side of the ankle and, beginning at the level of the lower border of the internal malleolus, a flap was lifted and split in an upward direction, care being taken at every step to avoid the division of any lateral

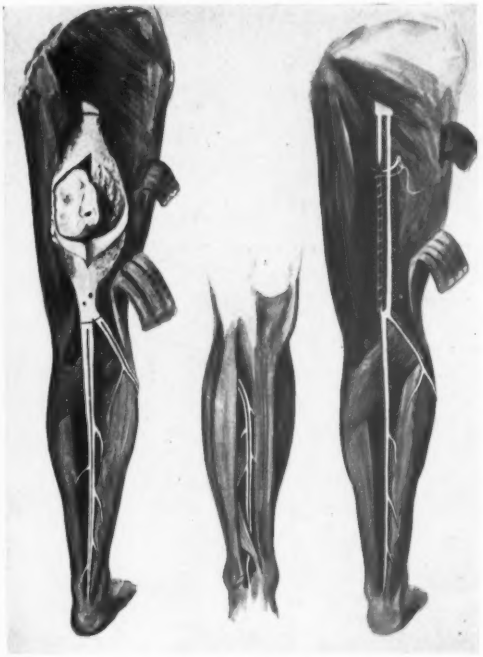


Fig. 2. Showing the position of the tumor, the part resected, method of splitting the internal and external popliteal nerves, method of bridging the gap, and scheme of suturing peripheral flaps in muscular bed. (Case 1.)

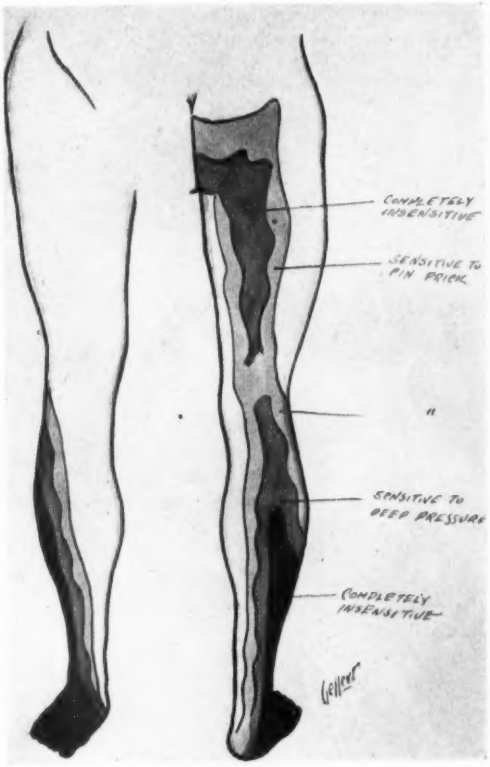


Fig. 3. Zones of disturbed sensibility in Case 1.

branches. The division and lifting of this flap was continued upward to within half an inch of the divided end of the internal popliteal nerve. This flap was sixteen and three quarter inches in length and its diameter a shade less than half the diameter of the nerve. Its end was implanted in a slit made in the stump of the sciatic nerve and held by two very slender chromic stitches. The filament was not more than a line and a half in diameter and contained four or five nerve fibers. It was handled with the utmost tenderness and buried from end to end by suture overlapping the underlying muscle, the motive being to avoid its destruction by scar formation and to permit the neurotization of the muscles of the leg. The wound was then sutured in layers and the entire length of the cutaneous incision closed by a subcuticular iodized catgut suture. The leg was invested in a plaster cast adjusted to the leg and thigh at an angle of 140°. The first dressing made on the tenth day found the wound united throughout by first intention.

Examination of the leg revealed but one change and it was very striking; the evidences of trophic disturbances were largely swept away and the leg now presented a much improved appearance.

Believing now that if the transplantation of a few fibers split from one popliteal would do good by establishing conductivity and promoting regeneration, that a few more fibers might augment the benefits, a third operation was performed on April 7, 1908, 67 days after the first operation and 46 days after the second. In the intervals, the limb was treated daily by massage and electricity.

The third operation consisted of an attempt to split the external popliteal nerve and utilize a flap in the same manner. This was a more difficult procedure but a flap of the same length was finally lifted up and tucked in a separate muscular bed on the outer side of the other branch, its end implanted into a cleft previously cut in the stump of the sciatic nerve. It was noted in this dissection that little or no scar tissue had formed in the line of the first transplantation. The wound was closed in the same manner and united by first intention. A few weeks ater the cast was removed and an adjustable splint applied which permitted the leg very gradually to be extended to a straight line. Thereafter treatment by massage and electricity was instituted and continued up to the time of his discharge (Fig. 2).

Examination within two weeks revealed marked improvement in the nutrition of the leg and all trophic disturbances seemed to have cleared away except over the central part of the anæsthetic zone, where the skin appeared glazed and patches of epithelial scales were in evidence. When walking was permitted after the removal of the cast, there was no pain or discomfort. After the lapse of three or four months the leg could be moderately flexed upon the thigh but the condition of foot drop was absolute. Progressive improvement hereafter took place in the motions of the leg so that it could be more readily flexed and extended.

Observations made within six months after the last operation revealed partial reaction of degeneration of the hamstring muscles and the flexors of the leg and complete reaction of degeneration of the flexors of the foot. Observations made one year after the last operation revealed electrical and motor recovery of the hamstrings and the flexors of the leg, partial reaction of degeneration of the extensors of the foot and complete reaction of degeneration of the flexors of the foot. Seven years later this man appeared at a meeting of the American Medical Association, in San Francisco, in 1915, in a discussion of a paper on nerve regeneration by Dean Lewis. The man is still living and whereas after a lapse of ten years there has been no recurrence of the disease, there has been continued recovery of function (Fig. 3).

Analysis of the effect of the injury. The excision of the sciatic nerve *in toto* predicates the elimination of all motor and sensory transmission throughout the area supplied by the sciatic nerve and its derivatives. The nerve was divided at the level of the gluteus maximus and the first branch delivered to the hip-joint was probably untouched. The muscular branches distributed to the flexors of the leg, namely, the biceps and semimembranosus and semitendinosus and the branch to the adductor magnus, were divided. These muscles afterward wasted and showed a state of flaccid atrophy. The area of sciatic sensory distribution was entirely cut out. In addition to the hamstring group of muscles already mentioned, the muscles supplied by the internal popliteal nerve, namely, the gastrocnemius, plantaris, soleus, and popliteus were deprived entirely of their nerve supply, wasted rapidly, and showed the reaction of degeneration. The flexors of the foot, tibialis anticus, the extensor longus digitorum, extensor longus hallucis, and peroneus tertius were shorn of their nerve supply and underwent the same paralytic changes. The extensors of the foot, namely, tibialis posticus, flexor longus digitorum, the flexor longus hallucis were similarly involved and likewise the peroneal group and all the groups of smaller muscles of the foot.

Previous to this operation it was held doubtful that regeneration could take place when the substance of the nerve is lost over a spread of two inches or more. Here a gap of ten and three quarter inches was made and the entire trunk of the sciatic eliminated. The theory has been held for a number of years past that regeneration can only take place from the central end of a nerve and more recent studies would tend to confirm this principle.

That regeneration on a colossal scale can take place and has taken place under conditions in which flaps taken from the peripheral ends of a divided nerve and utilized to bridge a gap ten and three quarter inches in length and fixed to the central end of the divided nerve and that they were successful in restoring motion and power to muscles completely paralyzed by the trauma, is manifest in view of the results obtained in this case and listed as follows: (1) Trophic recovery is practically complete. (2) There has been recovery in a limited degree of protopathic and epicritic sensibility. (3) There is almost universal recovery of deep sensation. (4) Recovery has taken place of motion and power in groups of muscles which, after the excision of the nerve, were reduced to a hopeless paralytic state—(a) the flexor group in the thigh, viz., complete recovery of the semimembranosus, semitendinosus, and the biceps; (b) the flexor group in the leg, viz., the gastrocnemius, plantaris, soleus and popliteus. Extensive recovery has taken place in this group which has been progressive, (c) the flexors and extensors in the phalanges and foot. Minute examination of these muscles show them to be strong and capable of contracting and while they do not move the foot they control it and there is but little tendency to foot drop. Some of the muscles of this group now show only partial reaction of degeneration. (5) The relatively small and contracted area of absolute cutaneous analgesia. (6) The rela-

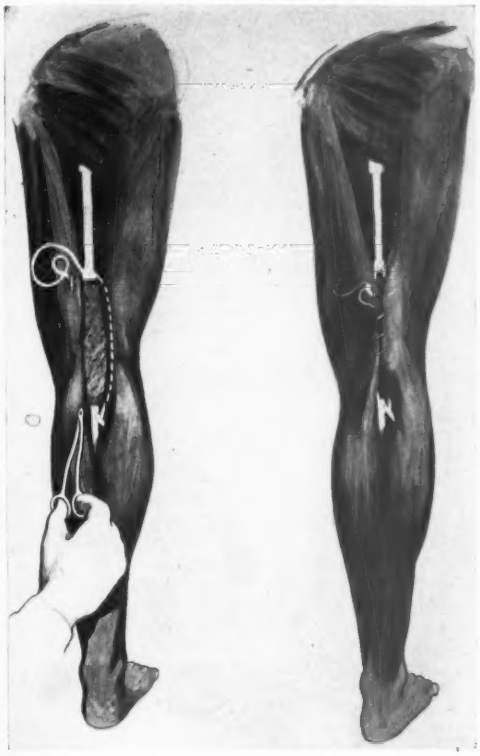


Fig. 4. Showing gap created by resection of segment of sciatic nerve and its branches destroyed by scar tissue; scheme of formation of central flaps and plan of avoiding scar tissue by tunnelling contiguous muscles for sequestration of nerve flaps; scheme of suture by (a) anastomosis of external popliteal into the internal popliteal nerve and (b) central flaps to their corresponding popliteal nerve ends (Case 2).

tively small area of thermic analgesia. (7) The direct sensibility of the new track of the nerve to deep pressure and the transmission of painful sensibility thereby to the foot. (8) Possession of muscular sense. (9) Independent and unaided locomotion; the man can not only walk long distances but can run at considerable speed.

The citation of the first case leads one to consider another in which a complete reversal of the methods was resorted to, viz., the utilization of central instead of peripheral flaps. Obviously no other method of treatment could be considered than the use of nerve flaps whether auto-, homo-, or hetero-

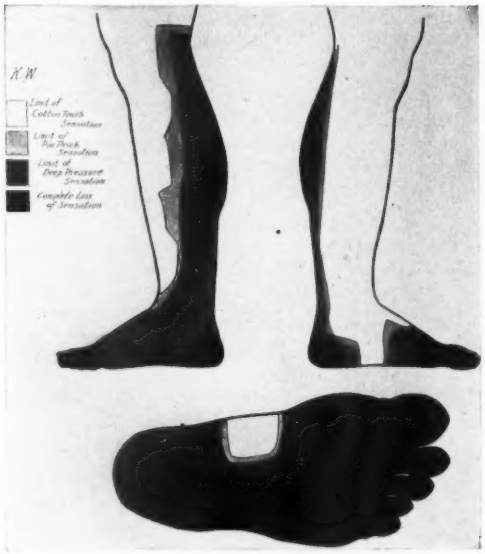

K.W.
Limit of Cotton Touch Sensation
Limit of Pin Prick Sensation
Limit of Deep Pressure Sensation
Complete Loss of Sensation

Fig. 5. Zones of disturbed sensibility in Case 2.

transplants. The second case refers to one which, because of a gunshot wound becoming infected, resulted in the formation of so much scar tissue as to lead to the destruction of a considerable part of the sciatic nerve and its two branches. So great was the destruction that a segment of four inches of the main trunk of the sciatic together with three inches of each branch had to be thrown in the discard. Although the results were not nearly so successful as in the first case because of qualifying conditions of unusual character antecedent to my operation over which I had no control, its salient features support the principles which the first case established.

K. W., aged 25, a very rugged type, sustained a gunshot wound of the left leg in September, 1915, with a thirty-forty expanding bullet. The bullet entered through the tendon of the biceps and came out through the popliteal space completely severing both the internal and external popliteal nerves. There was complete sensory and motor paralysis of all the parts supplied by both nerves.

An operation was performed for the relief of this condition by his surgeon, F. B. Bogardus, of Montana. Great care was exercised in this operation and the attempt was made to unite the divided ends of both nerves. Unfortunately the elements of infection were in the wound and the operation

failed in its purpose. After several months the wound healed but left a very extensive zone of dense scar tissue which occupied and extended beyond the popliteal space. The leg had a very forbidding appearance due to severe trophic shock; it possessed no power of motion at the knee because of contracture of tendons and scar-tissue contraction. The trophic changes were very striking especially in the region of the foot; the skin was harsh, purple and mottled, and covered with superimposed epithelial débris and vulnerable to the slightest injuries. Locomotion was possible under difficulties with the use of brace and crutch.

The muscles were found to exhibit the reaction of degeneration. The spread of the area of sensory paralysis was delimited before the operation and was found to correspond closely to the normal distribution of both nerves.

The first operation was performed May 17, 1916, and the approach to the divided nerves made in the center of the popliteal space. The nerves were traced with difficulty and found immured in dense scar tissue. They were literally dug out of their respective beds and tracked upward and downward to levels at which both nerves presented a normal appearance.

In the upward direction it was found that the main trunk of the sciatic was densely held and compressed in scar tissue for a distance of 5 or 6 inches. The internal popliteal was found to consist of nothing but fibrous tissue over a distance of three and a half inches. It was resected at levels which showed at either end nerve fibers. The corresponding segment of the external popliteal presented a very fair appearance and was left intact. The gap made in the internal popliteal was thereupon bridged by a flap taken from the sciatic, carrying with it eight or ten fibers of that nerve. The technique of this important step will be referred to at a later period in this report.

Both the repaired nerve and its fellow were then invested by a jacket of fascia lata over the areas involved and the wound closed after section of the hamstring tendons and a resection of so much of the scar tissue as safety would permit. The wound healed very well but because of the scar tissue and trophic disturbance, a skin-grafting operation was done June 26, which improved the conditions. The patient was discharged July 11, 1916, and sent to his home in Montana with instructions for treatment. On October 17, of the same year, he re-entered St. Vincent's Hospital and it was found that only a very minor degree of improvement had taken place. There was no recovery of sensation or motion. There was, if anything, greater atrophy of the muscles, and trophic disturbance, while improved, was still severe.

Realizing the failure of the first operation a second was proposed based on the assumption that a much better result would be obtained by an operation in which the drawback of scar tissue could be excluded and the nerves placed under conditions in which regeneration and recovery of function would be favored.

Accordingly on October 17, the popliteal space was reopened and the sciatic nerve and its branches again exposed. Once more they had to be taken out of their bed of dense scar tissue. The sciatic nerve, over a distance of seven or eight inches above the popliteal space, was released from its connections to which it was held by numerous adhesions. Those parts of the nerve which were enveloped in fascia lata at the former operation were found hopelessly matted in scar tissue. The lower end of the sciatic was palpated and was found to be compressed and condensed into scar tissue. Accordingly the last three inches of the main trunk of the sciatic and two and a half of both popliteals were cut out and thrown in the discard. For some distance above and below these levels the nerve trunks were found intimately adherent to the subjacent tissues.

The operative procedure. The sciatic nerve at a level of three inches above its bifurcation was divided and no nerve filaments being observed a series of cross sections were made up to a level which displayed nerve fibers. Ultimately the sciatic nerve had to be divided at a level four inches distant from its bifurcation. The internal and external popliteal nerves were treated in like manner and both divided at levels three and a half inches distant from the bifurcation. It was now evident that no system of treatment could be considered which would place the nerve elements in their normal anatomic position. Their fate could be easily forecast.

It was, therefore, decided to treat the divided nerve and bridge the large gap by a compound neuroplastic operation performed in a field remote from the zone of scar tissue. Two flaps containing six or eight nerve fibers eight inches in length were detached from both divisions of the trunk of the sciatic nerve by the following method: An ordinary slender silver probe, in preference to a cutting instrument, was thrust through a section of the trunk of the sciatic nerve between normal lines of cleavage and made to include the desired number of fibers. By a splitting process these fibers were separated downward to a level half an inch distant from the truncated end and the upper end of the split portion was then cut and the flap placed for the time being in a warm compress saturated with normal salt solution. A like flap was made from the other section of the trunk of the sciatic nerve and similarly treated. The next step consisted in anastomosing the popliteal branches. The same type of probe was used to make a cleft half an inch in length in the internal popliteal nerve one inch below its truncated end and into the cleft the end of the external division was carefully tucked and held in position by two or three slender iodized catgut sutures.

In order now to safeguard these delicate nerve flaps from the fate of destruction by scar tissue, the

following maneuver was resorted to: A long slender curved probe-pointed dressing forceps was passed through the muscular tissues as far afield as possible from the zone of scar tissue in the popliteal space; the forceps was caused to traverse the inner head of the gastrocnemius and semimembranosus, and on the outside the outer head of the gastrocnemius and the biceps muscles. The end of the forceps was made to merge at or about the level of the stump of the sciatic nerve. With the forceps the end of the outer filament was first seized and drawn through this muscular tunnel and sutured carefully to the truncated end of the internal popliteal nerve. By a similar maneuver the external filament from the sciatic was placed in its new muscular bed and its end in a cleft previously made on the outer aspect of the external popliteal nerve half an inch from the point of anastomosis. The wound was then closed and united throughout by first intention. The leg was placed in a position of mid flexion and was held there in a plaster cast. As soon as possible after the operation, treatment by massage and electricity was instituted and continued for many months (Fig. 4).

Inspection made during the month of May of the present year, two years after the last operation, revealed the following conditions: There is a striking change in the appearance of the entire leg, the color and texture of the skin look normal, the muscles are well rounded and developed. There is no trophic disturbance. Four or five months following the operation there was a response on the part of some of the muscles of the leg to the foradic current with slight movement of two or three of the toes. This very limited movement passed away in two or three months. Locomotion over a distance of four or five miles without adventitious aid can be easily accomplished. There has been moderate recovery of epicritic and protopathic sensibility. Deep pressure is felt over the area of the distribution of both popliteal nerves and transmitted down the leg. There is excellent control of the foot and the leg on locomotion permitting only a very slight tendency to foot drop. There has been no recovery of motion in the muscles supplied by the internal and external popliteal nerves. Notwithstanding, improvement in locomotion has been progressive. The foot is still vulnerable at points where the footwear presses unduly (Fig. 5).

Concerning this case it is only fair to say in estimating its values, that it presented from the beginning grave and almost insuperable difficulties. Infection was virulent and prolonged and invaded intimately the sciatic nerve and its branches over long stretches. They were compressed by the surrounding tissues and adherent to them. Their sheaths had lost their luster and were thickened, and doubtless the perineurial connective tissue investing the axis cylinders was the seat of cell proliferation. The material that entered into the formation of the flaps, therefore, was of very doubtful quality.

Notwithstanding these drawbacks, it is perfectly clear that extensive regenerative changes have taken place in the leg and that they are still progressive. Reasoning from analogy, basing the reasoning upon the results obtained in the first case in which not only individual but large groups of muscles were restored to power and function by the use of very long and slender peripheral flaps, it is held that under like favorable conditions, namely, early and timely operation and the use of sound central flaps, a larger measure of regeneration and recovery of function would undoubtedly have taken place

The third case illustrates the possibility of bringing about recovery of function in a divided nerve in the presence of infection in which there is a discharging sinus and bone necrosis.

O. I. entered my service in St. Vincent's Hospital, June 18, 1915, suffering from an ununited fracture of the right humerus, the result of a compound comminuted fracture sustained four months previously when she was thrown from her horse. In addition to the fracture there was complete division and paralysis of the musculospiral nerve.

An operation performed in Victoria, B. C., to reduce the fracture and restore the divided nerve, failed in its purpose. Infection of the arm was present. On entering my service a sinus was found at the junction of the upper with the middle third of the humerus leading to dead bone. There was also considerable infection with discharge. The musculospiral nerve was found to be completely paralyzed. Incision revealed a necrosed segment of the humerus an inch in length resting between the fractured ends, preventing union. The musculospiral nerve at both ends was found to lead into dense scar tissue. A fragment of bone was removed, the ends of the humerus delivered, and the end of each fragment resected. They were approximated and held by a steel plate.

It was then found that the gap in the nerve was too long to allow its approximation. Accordingly a flap one and a half inches in length was made from the central end and made to bridge the gap, and sutured to the other end of the nerve which was previously cross-sectioned until it showed the normal nerve fibers. The involved area was then surrounded by areolar tissue taken from the arm and invested by the underlying muscular fibers by an overlapping suture. A small cigarette drain

was inserted and held in position for twenty-four hours, and the arm invested in a plaster cast. The wound healed quickly thereafter.

It was reported eight months afterwards by her father that the hand could be lifted from the wrist into its correct position and within fifteen months this young woman was taking the massage course at McGill in war service doing her practical work at the Montreal General Hospital.

This case illustrates two striking features: first, that recovery may take place as a result of the use of the flap operation in a small peripheral nerve; second, that the operation can be performed successfully in the presence of infection. It suggests the important principle that the peripheral nerve when divided should be immediately restored whether in the presence of infection or not. It illustrates that in compound comminuted fractures associated with infection caused by violent injuries, successful results in the reconstruction of a member that is badly shattered may be achieved by the recognition of these principles.

This is the case for neuroplasty so far as this study is concerned. It is inconceivable that any other methods of handling these cases could have brought about equivalent results. Many military surgeons oppose resort to this method and depend, except when suture can readily be effected, upon steps to release nerves when found involved in adhesions, scars, or otherwise, and upon repairing them by devices of different kinds, designed always to bring about coaptation and suture end to end. With this purpose in view, joints are flexed, bones shortened, and nerves deviated, and other methods used to bring about the approximation of the divided nerve ends.

What is to be done in many cases of nerve trauma in warfare in which gaps are so great that the means referred to will not suffice? Are they to be left to their fate and denied any offer of reconstruction or repair? Is there not a place in very large breaches in nerves for the auto-transplant, the homo- or hetero-graft? Is there a place for neuroplasty in such cases? Is the experience recorded in these lines fatuous and misleading?

The study of these cases furnishes an opportunity for reflection on many phases of regeneration as they affect such delicate structures as nerves. We are aware that sensation, motion, and other impulses are transmitted through nerve trunks along definite paths, each fiber possessing a definite and limited function. There would seem to exist, however, other forces than these which pass through nerves which have not yet been explained and which play an important rôle in regeneration. Thus the first two cases demonstrate the transmission of a force which governs nutrition and quickly arrests trophic shock. The effect is almost immediate and very striking. They also demonstrate that muscular tone follows promptly upon the splicing of a divided nerve. The muscles without having motion develop a certain firmness, fullness and roundness and cease to undergo further atrophic changes. Other influences might also be mentioned.

Nerves are generally found in contact with muscle and muscle is naturally the protective environment of the nerve. The injured nerve, when the process of repair begins, recoils from contact with all tissues save its own. In muscle it finds a congenial soil for the reason perhaps that the first tendrils given off by the regenerating nerve find in the mesh of the muscle many fine little nerve filaments with which they can establish relations, In any event it seems certain that the muscle undergoes quick changes in form and substance if not in function as a result of the early repair of a divided nerve.

Objections are urged by writers to the mutilation of any nerve tissue for purposes of repairing damaged nerves. This would seem to be a mischievous law to lay down especially in the case of large gaps in nerves. It would deny the surgeon access to nerve trunks above or below the gap. What, after all, is the value of the sciatic trunk above a large gap? Is it not in great part like the branches below the gap without function and useless? What is more natural than the assumption that each tissue must furnish its own reparative material for its successful repair. Why should a different law apply to the nerve than to the tendon, muscle, or

blood-vessel? Why not utilize the trunk and its branches in all cases as freely as possible to repair large gaps in nerves in order to attain the maximum degree of regeneration and recovery of function?

The note sounded in the treatment of these cases by recent writers condemning these methods does harm to the cause of nerve surgery and might seriously affect the future of crippled soldiers who urgently need nerve repair as a means of their reconstruction. It is here urged that caution be always used in all cases of the kind under consideration looking to the utilization of nerve tissue that is known to be sound; that the utmost delicacy and tact be used in the handling of these delicate structures and that the region affected, especially the neighboring muscles and joints, be always placed in an ideal state for their recovery.

CONCLUSIONS

The study of this limited group of cases would seem to warrant certain deductions:

1. That regeneration and recovery of function is promoted by the use of nerve flaps.

2. That both central and peripheral flaps can be used for such purposes.

3. That a peripheral flap, by laying down a nerve path, may promote regeneration over a great gap; in one case quoted regeneration occurred over a gap ten and three-quarter inches in length.

4. That the approximation of nerves and their repair should be done in all cases with the least possible delay. (This would apply as well to cases which are infected as to clean cases).

5. That the arrest of trophic shock can be promoted by early closure of large gaps by flaps.

6. That unimpaired nerve tissue should always be utilized for the effective repair of damaged nerves.

7. That in their repair, nerves can be successfully sequestrated in muscular tissue so as to promote their own regeneration and that of the muscles in which they are embedded.

8. That the principle of sequestration can be utilized in proper cases so as to avoid infected zones in wounds and also scars and other obstacles to nerve repair.

SURGICAL CONSIDERATIONS OF PERIPHERAL NERVE INJURIES[1]

By BYRON STOOKEY, A.M., M.D.
Captain (Rel.) Royal Army Medical Corps, 1915–1916; Captain Medical Reserve Corps, United States Army.

THE more recent advances in our knowledge of nerve injuries has greatly modified the indications for surgical interference and the technique of peripheral nerve surgery. In a previous article (1) the various types of nerve injuries and their manifestations were dealt with in detail and do not enter into the scope of this paper. It is imperative that we determine, in so far as is possible, when to operate and what type of operation should be done.

Immediate suture in war wounds is rarely possible, because nearly all are infected. In war surgery many additional problems arise, due both to infection and the extensive destruction of tissues. The loss of nerve substance is frequently considerable and the amount of scar tissue present excessive.

It is a fundamental principle of nerve surgery that all operations must be done in a sterile field and in the absence of the possibility of infection. Hence, secondary suture is the rule. Recrudescence of infection in an apparently healed wound must always be considered. More especially is this true, when there has been extreme comminution of a fracture, or when there remain in the field scattered fragments of metal. The presence of these in an X-ray picture should mean a longer delay than might otherwise have been deemed expedient. Many times at operation these fragments are found walled off and surrounded by mucopurulent fluid. When such foci are broken into, infection may light up and the aim of the operation be annulled by increasing scar formation, both by another infection and by the added insult of an additional operation. Therefore, sufficient time must elapse to insure a clean, non-infected field.

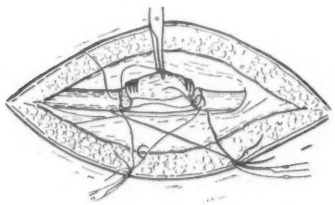
The aim of surgical interference is to facilitate the normal process of repair by removing all causes hindering the downgrowth of the neuraxes and to facilitate their growth, either through normal paths, i.e. by end-to-end suture, or down newly furnished paths, be they nerve transplants or artificial conducting paths.

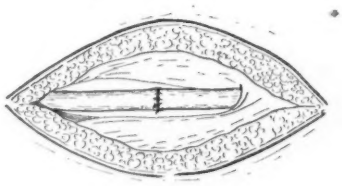
Since secondary operations only are permissible, at what period should they be undertaken? The first consideration is, as we have said, a sterile field. The second consideration is, the nature of the trauma and the progress of the nerve injury. Not all nerve wounds require operative intervention. A larger percentage, variously estimated between 40 and 60 per cent, recover without operation. Gerulanos (2), reporting cases from the Balkan war, claimed 40 per cent recovered. Tinel (3), in this war, places the percentage nearer 60. However, it is but just to state that in a considerable proportion of these the time of convalescence might have been materially shortened by a comparatively slight operation.

Unfortunately, with the exception of partial and incomplete nerve injuries, it is impossible to determine, except by waiting a sufficient length of time to allow for evidences of nerve degeneration to manifest themselves, whether a nerve will recover without operation. Therefore, it is of the greatest importance to study at definite intervals all available data and to be governed by the changing picture thus collected. The progressive changes are more important than the clinical picture at any one particular time. For this reason it is essential to have a report of the successive findings in any given case. The signal importance of early and frequent examination cannot be overemphasized; for it is only by such measures that one can become cognizant of the changing pathology of the lesion. Only by careful consecutive examinations, can proper and adequate treatment be outlined and needless delay prevented.

It is an axiom of peripheral nerve surgery that so long as there are progressive signs of nerve regeneration, no surgical interference

[1] On special detail in experimental nerve surgery under Dr. Huber, Director of the Department of Anatomy, University of Michigan.





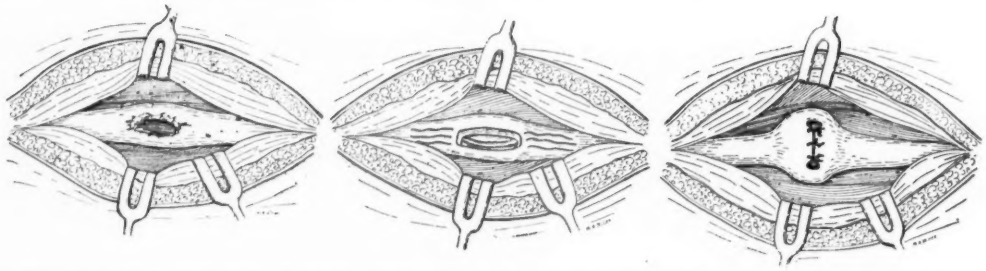
Figs. 1 and 2. Nerve with scar to be excised. Illustrates method of using scar as means of fixation of nerve ends, permitting greater accuracy and facility in suturing. Needle should enter slightly obliquely; tends to prevent suture from tearing out. Stay suture also helps to prevent axial rotation and can be withdrawn when other sutures are in place and tied. Note consecutive partial incisions through scar, until apparently normal nerve funiculi are reached.

is permissible. What, then, are the evidences of nerve regeneration? The earliest and most reliable are formication, shrinkage of areas of anæsthesia, return of deep sensibility, return of muscle tone and muscle sensibility.

Of these perhaps the most important and interesting is formication. This sign is elicited by gentle pressure upon the nerve trunk, producing thereby a peculiar creeping sensation referred to the peripheral distribution of the nerve. The progressive regions along the nerve at which this phenomenon can be elicited is an excellent guide of the progressive downgrowth of the neuraxes. Shrinkage of the areas of anæsthesia is a reliable early index of regeneration. The concentric contraction from above downward of the borders of loss to pin prick and temperature sense, expecially extreme degrees of temperature, are early signs of nerve repair. Frequently there occurs dissociation of temperature sense; extreme degrees of both hot and cold being confused, hot being appreciated as such one time and recognized as cold the next instant, and vice versa. Deep sensibility often returns earlier than other forms of sensation. The return of muscle tone and muscle sensibility occur at about the same time. There are other signs of nerve regeneration which manifest themselves further in the progress of recovery. The above signs of regenerating nerves give a very good index of the progress of their repair. As long as there are signs of progressive regeneration, operative intervention should not be undertaken. When these have ceased to advance or when, after due and repeated examinations, they have not appeared, surgical interference is definitely indicated. In from three to four months some evidences of nerve regeneration should manifest themselves. By waiting this long, little time is lost, since during the greater part of the intervening period the wound has been infected.

The time of operation will then depend on the progress of the case and the probability of a sterile field.

Considered from a surgical standpoint alone, the earlier the operation is undertaken the less difficult it is; the clearer the anatomical field; the better the operative end-result and the more complete the recovery. The longer the delay, the greater the amount and density of the scar tissue and callus; the more bound and fixed, in a retracted position, becomes the nerve trunk and the denser the connective tissue within the nerve. Furthermore, the longer the delay, the greater the secondary changes in the muscles and tendons, etc. Hence, from a purely surgical standpoint, there is every justification for early interference. The well-established fact that a certain percentage of nerve lesions recover without operation offers the only valid objection to early surgical interference. However, which cases will recover and which cases will not recover can be determined only by waiting evidences of regeneration. Rather than remain inactive too long, an exploratory incision should be made in certain cases. Unfortunately before operation even by the most careful examination, it is impossible to distinguish those nerve lesions with anatomical loss of nerve substance, from those with



Figs. 3, 4, and 5. Perforation of sciatic. Demonstrates method of suturing after excision of scar tissue. Line of excision should be sharp, avoiding as far as possible, normal funiculi. Plain catgut sutures are passed through and through and tied after all are in place.

interruption of conductivity without loss of anatomical continuity. When complete, both manifest themselves alike. By early exploratory operation those cases would be recognized, which could not offer any possible hope of recovery without surgical interference. Therefore, in selected cases, careful exploration is indicated.

No surgical procedure should be undertaken without electrical study, both before and during operation. Nerve operations are operations of choice and should be done where there is both ample facilities and ample time for thorough study.

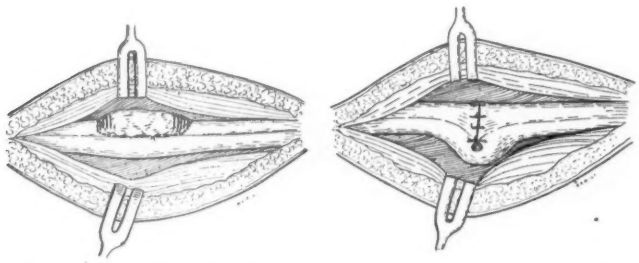
A general anæsthetic should always be used. When the patient is anæsthetized and before the incision is made, the extremity involved should be freely mobilized and adhesions broken up, so that the part may be placed and held in proper position after operative treatment. If there are contractures these should be corrected, in so far as is possible, before operation. Correct pre-operative and post-operative treatment unless properly carried out would very likely annul the success of the operation.

An absolutely dry field is one of the most important conditions of surgical technique. The use of the tourniquet is to be avoided, because each bleeding point should be dealt with individually. Kocher's blood platelet preparation, if available, is very helpful in checking capillary oozing within the scar tissue. A weak solution of adrenalin also gives excellent results. Hæmorrhage from the nerve ends is often profuse and is best controlled by gentle and prolonged digital pressure. Bits of torn muscle held over the nerve ends will be found advantageous in checking hæmorrhage. Blood between the nerve ends increases materially the amount of connective-tissue formation.

In wounds with the nerve imbedded in much scar and callus, it will be found safer to dissect from above down and from below up; from sound and normal tissue into scar. Much time will be wasted and damage done by searching in the scar for the divided nerve ends. The distal end usually is small, frayed, and diffused in the surrounding scar. Care must be taken in freeing the nerve not to cut nerve branches to adjacent muscles. For these reasons it is apparent that operations on peripheral nerves offer many difficulties and require both skill and patience.

When the nerve is freed from the immediate scar, it can be freed and liberated, in its contiguous parts by gentle traction. This is best done before excising the intervening scar. This admits of using the scar to make traction, thus avoiding additional trauma to the nerve trunk or nerve ends. Squeezing the nerve ends to make traction must be avoided.

It is good procedure to cut only partially through the scar, using it as a means of fixation for the nerve ends. Two things are thus gained: first, it is easier to suture when the ends are fixed; second, by so suturing there is less tendency to axial rotation and consequently greater accuracy in maintaining the internal topography of the nerve. The more accurate the union the more complete and the earlier the return of function. How-



Figs. 6 and 7. Partial injury to sciatic, peroneal portion involved. Nerve ends first mobilized. Series of multiple incisions with line of excision sharply made. Sutured with plain catgut without tension.

ever, it is many times impossible to attain union of divided ends with due regard for the internal anatomy of the nerve. Accurate juxtaposition should be, nevertheless, the aim toward which the operator should strive.

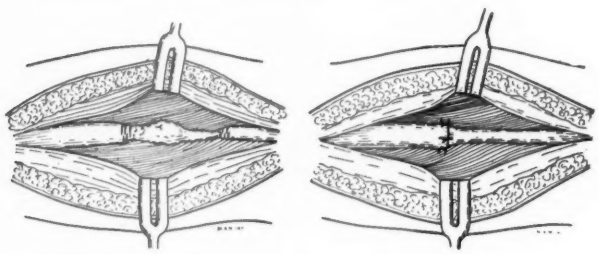
Small, smooth, round, half curved needles with either fine silk or plain catgut should be used. For smaller nerves, such as transplants, the finest silk is to be preferred. The suture should include as little of the nerve as possible. The nerve ends should be brought gently into alignment without pressure or tension. Care should be taken not to handle the nerve ends with forceps. A small amount of connective tissue will always form between the nerve ends. The thinner the layers of connective tissue, the less resistance will the neuraxes meet and the more complete the regeneration. A method which is especially to be commended is as follows: Three sutures are equidistantly placed, each including a little more than the epineurium (this is better than to take too little tissue for then the stitches are very apt to tear out and still greater damage be done in an effort to resuture). The suture ends are clamped and not tied until all three are in place. Each one acts as a guy suture in the placing of the next suture. If necessary, a primary stay suture may be used until the other three are in place and tied. This stay suture may also be of assistance in preventing axial rotation.

The type of operation depends on the anatomical findings, considered together with the clinical picture and the results of successive examinations. It is often impossible even at operation to determine whether or not nerve axes have reached the distal stump. If the axes are new and have not as yet reformed the motor end plates, then even though they have reached the distal stump, there would be no electrical response. A negative electrical response at operation is thus of little value. Longitudinal incision and partial consecutive incisions as well as palpation, may give additional information concerning the relative proportion of funiculi and scar tissue. Correct judgment can only be gained by wide experience and by checking observations by microscopical examination of the tissue excised.

There are three main types of operations: neurolysis or nerve liberation; suture, partial or complete; nerve grafting.

Nerve liberation consists in freeing the nerve trunk from all surrounding scar and callus. In many instances the nerve may be found completely included in scar tissue and the nerve trunk itself evaded. Nerve liberation is successful only when the nerve trunk has been completely freed and when there is no scar within the nerve. In the presence of interstitial changes, excision and nerve suture must be undertaken. In the instances in which there is slight interstitial scar tissue, conservative measures may be attempted. In such cases by injecting salt solution under pressure, into the nerve, adhesions may be broken up and new channels opened for the neuraxes since we know that neuraxes may grow through loosened scar tissue.[1]

[1] Dr. Elsberg makes a series of very small longitudinal incisions through the epineurium and thus opens new channels for the neuraxes. This method has much to commend it though I have had no personal experience in its use.



Figs. 8 and 9. Nerve caught in scar and callus. Distal extremity very much smaller; usually the amount of connective tissue, in the late cases, is increased. Small longitudinal slit is made in distal stump to permit epineural approximation and prevent in growth of scar.

This procedure when successful gives early and most rapid return of function and therefore is well worth trying in properly selected cases. Such cases constitute the major portion of nerve injuries which recover without operation. And even in many of these, recovery is astoundingly hastened by this simple operative procedure. If marked evidences of recovery do not take place within a few weeks, it is evident that there has been an error in judgment at the time of operation and a more radical procedure must be undertaken. However, if these possibilities are borne in mind, little time is lost and much may be gained. Hence, nerve liberation may well be essayed.

Direct nerve suture should only be done when the nerve ends can be brought in apposition without tension. Gentle traction may be used after the manner already described, care being taken to avoid too strenuous a pull, since by so doing karyolysis of the motor cells in the anterior horn takes place, with subsequent degeneration of the neuraxes within the proximal stump—a result to be studiously avoided. Defects in the nerve may be lessened by altering the position of the extremity. The position varies with the nerve and the level of the lesion. By means, then, of stretching and altering the position of the limb a few centimeters may be gained; three to five in the upper arm and five to six in the thigh. The nerve ends must not be sutured under tension. If this is done with the limb in the overcorrected position, an elongation and an increase of the scar results, and probably would prevent the downgrowth of the neuraxes.

When excising *scar* within the nerve trunk, it is imperative to excise liberally. There should be little or no regard concerning the amount of *scar* removed. The sole consideration should be to cut until normal tissue is reached. The problem of nerve bridging must then be considered and then only. Great caution should be observed not to remove tissue needlessly. This is best safeguarded by making relatively thin consecutive sections incompletely through the scar, or the neuroma. In this manner one can better recognize approaching normal nerve funiculi.

Partial nerve suture is rather frequent in injuries of the larger nerves, more particularly the peroneal portion of the sciatic. The aim here is to remove all interstitial scar without section of the normal nerve funiculi. The incisions should be sharp and clean cut, avoiding all tearing of the nerve. The same suture is to be used and the same technique as in complete suture.

When the defects are extensive, as unfortunately they frequently are, nerve grafting is the operation of choice. The nerves used are the radial, just below the elbow and the musculocutaneous of the arm and leg, either as single or multiple grafts. The method of suture varies little from that of complete suture.

When possible the nerve should be very loosely surrounded by a pedicle of fat which is carried beneath the nerve and passed back over the superior surface and there anchored.

The pedicle should be very much larger than the area to be covered to allow for subsequent shrinkage and should be selected with some consideration as to blood supply. The opportunity may also occasionally present itself to transpose the nerve trunk between muscle bellies or to imbed it in an adjacent muscle.

Concerning the physiology of the graft and other methods of nerve bridging, such as tubulization, I do not wish to consider at this time. Huber (4), in a monograph on the study of the operative treatment of the peripheral nerve injuries, and more recently in a short critical review of the numerous operative procedures, has discussed in detail their relative value and I would refer to both of these for much information and light on the surgical repair of nerve lesions. Had neurological surgeons been cognizant of the work of Huber in his monograph, published some 20 years ago, nerve surgery might have been very materially advanced. Nevertheless, it is necessary to point out here that none of the methods of tubulization have been reported with a sufficient number of end results to admit of forming definite conclusions and hence should be used with reservation. Hirschel (5), reports the use of Foramitti's hardened arteries, and himself states that none of the cases had been observed for a sufficient length of time. Grosse (6) also reports their use in 18 cases and in none again had enough time elapsed. Foramitti (7) reported experiments in but three dogs. Two were killed at the end of three weeks and one at the end of six weeks. This obviously is too short a period of observation. Therefore it is timely to call attention to the fact that in using fascia, veins, cargile membranes and hardened arteries, etc., these methods are still in the experimental stage and the results of laboratory investigation should be awaited.

Where nerve defects are extensive, shortening the limb by excising the bone is never justifiable. Usually some form of plastic operation can be done which would give better end-results.

In a few particular injuries, when considered as a whole, it may be deemed expedient to do tendon transplantation rather than some form of nerve bridging. Colonel Sir Robert Jones (8) has discussed in an admirable article, the numerous possibilities of this alternative. I have seen some of Captain McMurray's cases of tendon transplantations at Alder Hey, and his results in musculospiral cases are to be highly commended.

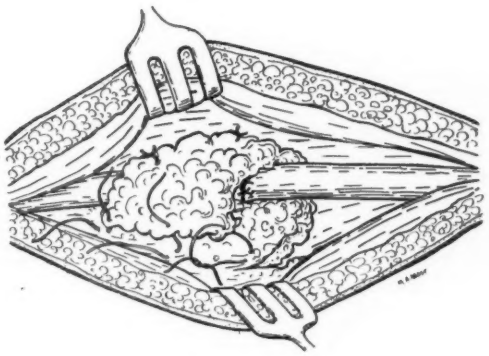
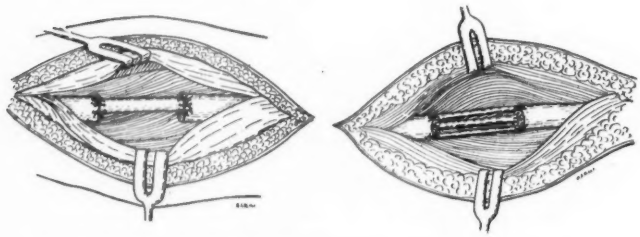


Fig. 10. Nerve sutured in scar bed. Pedicle of fat. Pedicle loose and relatively large. Note suture of fat to fascia away from nerve, to prevent pressure or contraction about nerve. Fat is not sutured to the nerve. (The opportunity to obtain a proper fat flap is rare in war wounds.)

The most frequent complication encountered in operations for the repair of peripheral nerves is injuries to blood-vessels, including thrombosis and aneurism. In not a few instances the nerves are bound down in a mass of scar tissue and intimately adherent to the great vessels. Aneurisms are particularly found in injuries to the plexus, cervical and brachial, and also to the nerve trunks in the axilla. Such complications can usually be recognized before operation. Occasionally they are not recognized and are masked by the nerve injury and unless borne in mind at the time of operation may lead one into extreme operative difficulties. Aneurism should be suspected when there is extreme atrophy together with considerable fibrous change in the muscle. The picture borders onto that of Volkmann's contracture. If the cardinal signs of traumatic aneurism are looked for they usually can be elicited. The combined nerve and arterial lesion is difficult to handle and offers a poor outlook.



Figs. 11 and 12. Single or multiple autogenous grafts; usually the radial or the musculocutaneous of the arm or leg. A single, through-and-through fine silk suture is carried through the graft, thence into the cut surface of the nerve and out onto the epineurium. The graft is gently approximated to the nerve without trauma or tension.

Another complication, occasionally found, is injuries to the apex of the lung. At the time of injury these are overlooked due to the extreme paralysis as a result of the lesion of the plexus. In cleaning out the scar tissue and in freeing the nerve trunks at the operation for nerve repair, the pleural cavity may be again opened. Such a complication should always be thought of in injuries to the lower cervical trunks.

In cases in which there is exquisite and intractable pain, surgical intervention may be indicated in spite of evidence of progressive nerve regeneration. The exact pathology of causalgia is not fully understood. However, some are produced by pressure on the nerve from without and by scar formation within the nerve. In the former group relief may be immediate after freeing the nerve from the scar, callus or from around bony exostoses. When the cause lies within the nerve, Sicard (9) has recommended the injection of 60 per cent alcohol. With this method I have had no experience.

In view of the comparatively large number of peripheral nerve injuries, the seriousness of their disability, the protracted time that they are under treatment and the relatively hopeful outlook, when properly handled, it is imperative that they be given the benefit of the more recent advances and the soundest principles of treatment.

In conclusion, it is a particular pleasure to express to Dr. Huber my deep appreciation for many valuable suggestions and much practical assistance.

REFERENCES

1. Stookey. Gunshot wounds of peripheral nerves, Surg., Gynec. & Obst., 1916, xxiii, 639.
2. Gerulanos. Schussverletzungen der peripheren Nerven aus dem Balkankrieg. Beitr. z. klin. Chir., 1914, xci.
3. Tinel. Nerve Wounds. William Wood and Company.
4. Huber. A study of operative treatment for loss of nerve substance in peripheral nerves. J. Morph., 1895, xi; Operative treatment of peripheral nerves after severance, more particularly after loss of substance. A critical review. J. Lab. & Clin. Med., 1917, ii, N. 12.
5. Hirschel. Erfahrungen ueber Schussverletzungen der Nerven. Deutsche Ztschr. f. Chir., 1914-15, cxxxii.
6. Grosse. Schussverletzungen peripherer Nerven. Beitr. z. klin. Chir., 1915, xcvii.
7. Foramitti. Zur Technik der Nervennaht. Arch. f klin. Chir., 1914, lxxiii.
8. Jones. Brit. M. J., 1916.
9. Sicard. Traitément des nevrites douloureuses de guerre. Presse méd., 1916, No. 31, 241.

IMPROVEMENTS IN RECONSTRUCTIVE SURGERY OF THE HEAD[1]

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THE frequent deformities, due to gunshot injuries and burns in civil and military life and those developed in the scars of operative mutilations claim surgical attention. Variation of detail inures in the plastic repair of lesions of different regions of the body from the causes mentioned. Nevertheless, the principles of the surgeon's reconstructive work and the steps, through which the organism responds to his desires, are essentially the same in head, trunk, and limbs. An ignorance, which often causes surprise, still exists in the minds of some as to the usefulness of treatment for cicatricial deformity of the face. This lack of knowledge of recent progress in operative surgery appears not only in rural populations but is constantly exhibited by dwellers in large cities.

Congenital malformations, like harelip, cleft palate, webbed digits, and cicatricial distortions from slow healing of burns and crushing injuries appear at metropolitan hospitals for treatment months, even years, after the precious early moment for corrective surgery has passed.

Appreciation of the value of prompt plastic aid is gradually being instilled into the minds of surgeons by the lessons of the present European War. The energy exhibited by the contracting force of fibrous tissue, when it replaces granulation tissue in wounds is astonishing. Carrel and deNoüy have shown that, when open wounds are compelled by infection to heal through the conversion of granulation tissue into scar tissue, the major part of the closure is effected by dragging the boundaries of the ulcer toward a central point. Thus it is that the epidermization is reduced to a minimum and the cutaneous defense against ingress of micro-organisms re-established. The effect of this interstitial contraction, however, on the surrounding and underlying structures is lamentably evident. Slow healing of wounds or ulceration after operation or separation of dead tissues, may cause eversion of lips and eyelids, closure of orifices, strictures of ducts, adhesions that restrain the movements of joints, and may even lead to dislocation of the fingers and toes.

Reconstructive surgery is simply a part of general surgery, which has been developed by a study of nature's methods of repairing wounds and the adoption, by the surgeon, of such mechanical aids as will further the re-creation of normal contours and re-establish prior functions. Its object, in the main, it may be said, is the construction of absent or lost parts, and the reposition or curtailment of parts displaced or deformed by injury or disease.

The deformities which it is designed to correct may be grouped as those due to—

1. Imperfect fœtal development, such as webbed fingers, cleft palate, supernumerary digits.

2. Ablations of tissue, as in war wounds, and operations for injury or malignant disease.

3. Ulceration or necrosis, as in urinary and salivary fistulæ, occlusion of orifices, stricture of canals, loss of portions of the skeleton.

4. Contraction of scar tissue, causing adhesions about joints, eversion of lips and borders of orifices, fibrous ankylosis of articulations.

5. Overgrowth or irregular contour as in gigantism of nose and ears, flaring ears and adipose overgrowth in abdominal wall.

6. Conversions of rigid structures into movable ones, as in bony ankylosis of joints; and flaccid structures into rigid ones as in operations for non-union of fractures.

Recent developments have taught that nearly all tissues can be repaired by plastic procedures, if the operative technique is mechanically efficient, provided that the wounds be kept aseptic from the moment of their production to the end of the period demanded by nature for the metabolic re-establishment of function. The functional

[1] Read at the meeting of the American Surgical Association, Cincinnati, June 6, 1918.

repair may be inferior to the original status of the parts; but re education of the patient's mind, nervous system and circulation accomplish in time wonderful increase of efficiency. The change of a slender graft of bone, placed between the epiphyseal ends of the tibia after necrosis, into a thick weight-bearing column seems nearly miraculous. The return of sensory and motor function to fingers after nerve grafting in the arm almost resembles the raising of the dead.

Under some circumstances, a failure to maintain an aseptic condition of reconstruction wounds does not imperil the ultimate results very much. It does, however, prolong the time of recovery. This statement is applicable especially to osteoplastic operations.

The patient to undergo operation should be in good health and the tissues, with and upon which plastic operations are to be done, should be free from local deterioration. The operative field and technique must be aseptic and the after-treatment should maintain a similar freedom from infective agents. The great adversary in plastic surgery is bacterial infection; the other enemies of success are tension on sutures and too early disturbances of the repaired tissues. Meddlesome inspection by unskilled assistants is a great danger. The surgeon usually will do well to permit no early mobility and prohibit any one but himself or a trained coadjutor looking after the dressing of his operation wounds. The prolonged fixation is of pre-eminent importance in bone grafting of fractures, except perhaps in mandibular reconstruction.

The methods of plastic surgery are:

A. Displacement: (a) approximation, as in harelip; (b) sliding to transfer tension, as in ectropion.

B. Interpolation, borrowing material from vicinity, from another region, or from another person or animal: (1) transferring flap with pedicle—(a) at once, (b) by successive migrations; (2) transportation with pedicle—(a) direct, from hand or arm, (b) indirect, by using hand as carrying agent; (3) transplanting without a pedicle (grafting).

C. Enthesis: burying in the tissues foreign bodies, such as paraffin, wire, metal, glass, rubber.

D. Retrenchment: cutting out ellipses or wedges, as in gigantism of ears and nose.

E. Substitution: cæcum for bladder, bowel for vagina, appendix for urethra.

F. Strategic: temporary displacement, as mandible to get at pharynx; zygoma and cranium to reach brain.

The operative steps in simple procedures are—

1. Freshening edges and cutting away fibrous scar tissue if new tissue is to receive blood-vessel connection therewith;
2. Obtaining flaps, if necessary;
3. Arresting bleeding;
4. Adjusting parts in proper relation without tension; with sutures, tacks, staples, Michel clips;
5. Closing gaps left by cutting out flaps;
6. Dressing wounds aseptically, and keeping them aseptic;
7. Preventing too early motion and undue handling of tissues reconstructed.

In complicated procedures, a series of operations extending over months may be necessary, each operation forming a basis for the succeeding one. Too much should not be attempted at once. Sufficient time should be allowed for healing and contraction.

METHODS OF PLASTIC SURGERY

Manner of making cutaneous flaps with pedicles. Pediculated flaps should be large, thick, and with a good vascular supply through a wide pedicle. Artery and vein may be in the flap or partly denuded of skin. The subcutaneous fascia must be included. Because the skin when cut loose contracts, the flap should be 30 to 40 per cent larger than the opening to be covered.

The edges of the gap to be covered should be freshened by cutting away the fibrous cicatrix before making the flap.

This flap should be made so that the cardiac end with artery runs into its base.

The long axis of the flap should correspond with the direction of arterial supply. This rule may be neglected if the anastomosis is free.

It may be well sometimes to cut the flap and wait a few days before stitching it in place. Care should be taken not to twist the pedicle so much as to close the artery or vein.

The arterial supply or venous discharge should not be impeded by tension.

If either event is evident on the second day, the stitches should be taken out to restore the arterial current, or the flap should be punctured with deep incisions to lessen venous engorgement. Injurious tension may be relieved by making a pedicle with curved or angular borders.

Hæmorrhage should be stopped before applying the pediculated flaps and the flaps should be placed loosely, not in a stretched condition.

Manner of making transplants (or grafts). The tissues must be aseptic, not antiseptic. The grafts must be aseptic and not injured by mechanical or chemical irritants. The surfaces to be grafted and surfaces from which grafts are to be obtained, should be sterilized if not already sterile. If antiseptics have been used, the surfaces should be bathed with sterile normal salt solution. The grafts should be kept wrapped in dry gauze at operation. Carrel uses grafts kept in cold storage for long periods. Pieces of skin, nerve, fascia, fat, tendon, cartilage or bone may be used as grafts. Skin grafts of whole thickness should have the adipose tissue clipped off. The graft should be placed in contact with like tissue where a gap exists. The graft should be held in place by pressure or sutures. In skin grafting, the air should be pressed out from under the graft.

Dressings. Mild antiseptic solution may be painted along the wound if pediculated flaps are used. No antiseptics may be used with transplants (grafts). Dry gauze dressing should be used, aseptic of course. Warmth by dry heat outside the dressing, when blood supply is doubted, may be necessary. The wound should be kept quiet and the dressings should not be disturbed early or often. The wound should not be uncovered earlier than the fourth or sixth day, if free from contamination with saliva, or mucus from the mouth, nose or eye.

Face wounds will often do very well without any gauze dressing. I usually prefer none, or but a *single* layer of dry gauze.

Results. Pedunculated flaps, or grafts that remain healthy for four days are not apt to slough. If within this period the flap or graft becomes grayish, pulpy, and shows loosened cuticle, venous gangrene is probable. If, however, it becomes whitish, then dark and withered, arterial gangrene is probable. If gangrene seems imminent, it is possible that only an upper layer or the edges will die. Hence do not cut away slough too hastily. In arterial gangrene, take out the sutures that seem to cause tension, even if you separate the whole flap except the pedicle. In venous sloughing, scarify and puncture the tissues of flap and also relieve tension of pedicle by cutting a few sutures or untwisting pedicle.

Fig. 1. (At left). Excision of mandible. Two inches removed with Masland electric saw. Rigid metal wire inserted in mandibular canal to hold fragments apart. Photograph taken several weeks after operation.

Fig. 2. Uranoplasty for congenital double cleft of soft palate. Horseshoe flaps displaced backward and anterior edge held against bony palate by intranasal suture. Faucial pillars were temporarily stitched together.

The innumerable head injuries of the present war and the energy of military surgeons, who have been brought into contact with these traumatisms, have given a great impetus to the study of reparative surgery of the head. In the civilian school of plastic and oral surgery, established by the Surgeon General of the Army at Philadelphia, marked interest was at once evident in the laboratory practice of this branch of reconstructive surgery. Old methods were made familiar to the younger men; new ideas and procedures penetrated the indurated brains of those who were older. As must always be, we the seniors have been

Fig. 3. Appearance of mouth after union. Taken five weeks later. Union complete. Shadow at left is not to be mistaken for a fissure.

greatly impressed by the progress in plastic surgery developed by men of less age than ourselves. To call attention to some of the new ideas in plastic surgery of the head and to set down some of the opinions, which war surgery has crystallized in the minds of men, is the chief object of this paper.

Surgeons have been taught to realize that important elements in the treatment of war injuries are prompt readjustment of tissues and immobilization. In gunshot fractures of the mandible, for example, prompt immobilization followed by restoration of a relatively normal dental occlusion have been accepted by general and dental surgeons as factors of great moment. Instances may arise in fractures with loss of bone, which justify coaptation and fixation of the ends of the remaining fragments with forfeit for a while of the proper occlusion of the remaining teeth. These injuries are not so common as those in which temporary interdental splinting to fix the fracture and maintain an approximately normal bite will be more advantageous.

A large proportion of mandibular fractures in war are not only comminuted but also contaminated, and probably already infected when seen by the surgeon. Prompt fixation of broken bones in the limbs has long been an axiom of general surgery. The rule applies even more rigidly to comminuted and open fractures, sure to become infected, in the oral region. Hence fixation before transportation applies to gunshot fractures of the lower jaw bone. While it is true that the constant flow of saliva and the ease of establishing submental drainage by incision usually will lessen the violence of septic complications in mouth injuries, it is almost obligatory that imbedded foreign bodies, in the floor of the mouth and the neck, be immediately removed to avert infection. The term foreign bodies includes bullets, shot, shrapnel, pieces of clothing or shell casing, gravel, displaced teeth, and small unattached splinters of bone. Large pieces of bone covered with periosteum should not be disturbed, but replaced as accurately as possible.

Early reconstruction of the skeletal foundation of the face is an important factor also in maxillary and nasal fractures. For this purpose, general anæsthesia may sometimes be demanded. It is securable with nitrous oxide gas or the primary anæsthetic effect of ether. Conductive anæsthesia with cocaine or novocaine may be sufficient. Early excision of contaminated structures followed by immediate and loose suturing of wound edges will often be followed by early healing. As the bones of the face in uninfected fractures unite quickly, prompt restoration of bony contour should be a law of treatment. The same rule, by the way, applies also to replacement of torn and displaced integument and other soft parts. Facial deformity from trauma is often a discredit to the original surgical attendant. Much satisfaction will come to the family physician, who, though not a surgical specialist, has grit enough to administer the first aid to a lacerated face in much the same way that his wife would act upon his torn coat. To put the torn edges at once in place, and keep them there with stitches, would be her motto. He should do the same with a torn face; but would better not use continuous sutures and should leave space for ooze of blood and drainage between some of the stitches. She would perhaps

wash her hands before starting the job. He should clean both his hands and the patient's face ere he sew up a wound.

When there is a considerable loss of bone in a gunshot fracture or after excision of the lower jaw for malignant disease, the ends of the fragments remaining should be held apart with a spreading dental apparatus to prevent dragging of the ends together by muscular action. The resulting contraction, if not thus averted, will become confirmed by muscular and cicatricial changes and a V-shape jaw or other deformity produced, which may be curable never or only after months of painful treatment. If the ends are held apart by a temporary interosseous mass of modelling compound, a wire brace in the bone, an interdental splint or other fixation apparatus for a few weeks, the fragments will remain apart. Then a permanent prosthetic appliance may be adapted or an osteoplastic operation performed to complete the body of the mandible and restore facial contour. (Fig. 1.)

Large flaps of skin and muscle may be swept from their bony attachments in machinery accidents and in military rivalry. The primary appearance of a patient whose face is so ripped apart is appalling. The bloody masses of integument, muscle, and mucous membrane may be smeared with tears, saliva, and dirt, and contain fragments of bone, detached teeth, food and vomitus. Speech may be almost impossible from laceration or swelling of the oral structures, and asphyxia impending. Thorough cleansing (sometimes with excision of damaged tissue) and an immediate replacement of the huge flaps, torn from scalp, forehead, cheeks or chin, will restore the patient's visage to a fair resemblance of a human face. It will also add vastly to the chance of moderate septic symptoms and lessen deformity from scar distortion.

The availability of ordinary carpet tacks and small staples for keeping the replaced tissues in contact with the underlying bones will be recognized by surgeons with a mechanical turn of mind. Dental surgeons have shown that spring trusses somewhat like inguinal hernia trusses may be used for this purpose where sutures seem unserviceable. Use is

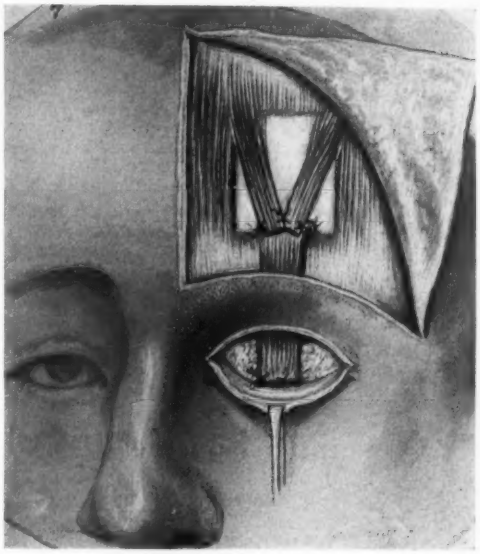

Fig. 4. Diagram of Robert's muscle substitution operation for ptosis of upper eyelid.

made of the floor of the nose or an intermaxillary splint is inserted, to give a supporting base for the spring; extensive flaps may thus be kept in normal relation to the uninjured structures. Wire or silkworm-gut sutures, inserted into the loosened integument, may be carried by means of long, straight needles through the deep structures into the mouth; there they may be fastened to the teeth of the upper jaw. A piece of wire twisted around the neck of a canine tooth, or fastened to a hook soldered to a metal band, clamped on any available tooth, will give the oral end of the suture the desired hold. Any convenient tooth may be used as the anchor.

I have tacked with much satisfaction a plastic flap from back to cranium in accidental scalping of a child. In plastic operations on cleft palate, a valuable expedient in some forms of uranoplasty is to hold the bilateral mucoperiosteal flap against the denuded bones with a long mattress suture, the two ends of which are carried up through the palate cleft into the nose and out the anterior nares. Here the ends are tied together outside of the columella. One end may be made, with

Fig. 5. Excising mandible of cadaver with Masland electric saw.

Fig. 6. Sawing out tibial graft with Masland saw for bone grafting mandible.

a needle, to perforate the quadrangular cartilage of the septum so that the two ends may be knotted together, just within the orifice of one naris. This intrapharyngonasal suture, I have employed recently in several operations and believe it an improvement in technique. (Fig. 2.)

Another recent detail in plastic closure of cleft palate was suggested, I think, by J. R. Eastman. He draws the pillars of the fauces toward each other with a catgut suture after the uranoplasty is completed, in order to take the strain off the stitches in the soft palate. This non-chromicized suture is absorbed in a few days, when its support is no longer needed. It is valuable to prevent too great tension on the other sutures in the period of greatest danger, which is immediately after the recovery from anæsthesia during a few days after that of operation.

Similar control of a tongue, when detached by gunshot or operation, may be obtained with a suture through its base knotted around the hyoid bone. After the tongue has lost its hold on the genial tubercles of the mandible, by reason of excision or avulsion of the median part of that bone, the danger of asphyxia from the tongue falling backward during sleep may be great unless it is thus averted. (Fig. 3.)

Ptosis of the upper eyelid, whether due to traumatic paralysis or that from congenital defect in the nerve supply, I have relieved with considerable success by a muscle substitution operation, when the fibers of the occipitofrontalis muscle have their normal innervation. The result is shown well in a child with bilateral congenital palpebral ptosis. In her instance, on one eye I operated by the method called the Wilder method with only moderate success. Upon the other, after failure of the Wilder method, I used the one suggested by me.

It consists in turning down a band of muscle from the frontalis and thrusting it through a tunnel beneath the skin of the brow so as to be fixed with sutures to the upper edge of the tarsal cartilage. This is accomplished by turning up a flap from the forehead by means of a vertical incision near the middle line and a curved cut within the eyebrow. Two strips of muscular fiber are attached at the bend in the overturned muscle; these are cut from the sides of the gap left in the frontalis by the transfer of the first band of fibers, which has previously been stitched to the tarsal cartilage. Figure 4 is a schematic drawing showing the method.

Injurious tension on sutures employed to bring skin flaps together, across a wide gap, may be neatly lessened by sewing hooks on strips of adhesive plaster. One of these hook-strips stuck to the skin on each side of, and parallel to, the wound furnishes a ready means of lacing up the skin so as to take strain off the sutures. Subcutaneous absorbable sutures serve a similar purpose.

NOTES ON METHODS OF PLASTIC SURGERY

Lexer, of Berlin, published a few years ago the results of researches by himself and others in physiological and clinical investigations of

Fig. 7 (at left). Making osteoplastic cranial flap on cadaver with Masland saw (Model 1918) and Robert's trephine made in 1881 for trephining with Bonwill dental engine. Figure also shows bonegraft wired into mandible after employing Masland saw.
Fig. 8. Osteoplastic flap so made everted.

plastic operations. In this country, Davis has contributed valuable ideas; among others the use of rubber netting to hold skin grafts in place against the unhealed tissues beneath. Esser, of the Austrian army, recommends what he calls epidermic inlay with dental modeling composition. This device keeps Thiersch grafts in accurate contact with the underlying surface by means of pressure from a negative of the surface, made of sterile dental compound. The method is available for skin grafting, the raw surface of a skin flap to be used for repairing the mouth or cheek, to deepen the conjunctival sac for wearing a glass eye, or to obtain an epidermic surface on both sides of a flap for any operation. In the last case, the surgeon freely undercuts the intended flap; makes a cast with heat-softened modeling composition, which soon hardens, of the cavity under the skin; covers the entire surface of the cast with thin skin shavings with their epidermis against the cast; pushes into the hole the cast covered with grafts, and sews up the wound. Two weeks later, he removes the buried cast from the cavity by an incision. These maneuvers furnish one or more flaps with normal skin on one side and Thiersch graft skin on the other. These are used for the next step of the intended operation.

One of the most satisfactory outcomes of the present interest in osteoplastic surgery, so far as my own work is concerned, has been the great improvement made by H. C. Masland, of Philadelphia, in his osteoplastic saw. I have used it in operating room and the surgical teaching laboratory. He has now devised an instrument superior to any electric saw, with which I am acquainted. It is convenient in size, and may be readily sterilized; it makes with accuracy and rapidity the osteoplastic trap-doors needed in brain surgery, the bone grafts from the tibia used in fractures and in tuberculosis of the vertebræ, and gives the surgeon an ever ready instrument for excision of mandible or rib. It is run by a motor and flexible cable, and is guided with one hand of the surgeon with almost the convenience and delicacy of a pocket knife. In craniectomy two small openings are made with an electric trephine or flat burr, devised by me long years ago, or with any form of perforator, to gain an entrance for the dural separator. The saw then cuts vertical or oblique incisions in the bone at the surgeon's will, and enables him to operate with one hand expeditiously and safely without danger to the patient, himself, or the fingers of his assistants.

The usual accessory instruments, run similarly with an electric motor and cable, provide a rapid means of drilling bone for wiring fractures, making dowels, trimming pegs and cutting slots for inlay grafts. The accompany-

ing photographs will give an idea of how Masland's saw has proved a convenience to me. I became acquainted with it a long time ago; but have only within a few weeks seen his improved model. This is far superior to his original tool though that at once impressed me as having features not possessed by any other surgical saw for cranial operations then known to me (Fig. 5).

Seeing during the past winter Masland's successive improvements in his osteoplastic saw has revived my interest in cranial perforation, an operation so important in general and plastic surgery. The *Philadelphia Medical Times* published, on December 31, 1881, pp. 206–207, a short article by me detailing some experimental work on the cadaver with a flat face burr rotated with the Bonwill surgical engine. I used what was called by the dental instrument maker a fissure burr to trephine the skull and elevate a depressed fracture. With this burr I readily made a circular cavity in the outer table of the cranium. This was carefully deepened until the vitreous table was perforated. There was no disk to remove, because the burr threw out all the bone-dust; thus it enabled me, by withdrawing the burr from time to time, to observe the character and depth of the perforation being made. A circular hole about one quarter of an inch in diameter was quickly cut through the brain case, exposing the dura mater without injury to it or the enclosed cerebrum. A steel elevator was inserted into the hole and used to prize up the depressed fragment driven upon the brain by the crushing blow which had previously been given.

My deduction was that such a burr would readily grind away osseous tissue, but, though rapidly rotating, would not be likely to injure by abrasion the surface of a soft structure like the dura mater. I could run it against my soft finger tip without injuring the skin. The convenience of the method was seen to be enhanced also by the ease with which sharp and irregular fracture edges could be cut smooth with the burr used to make the opening in the cranium.

I quote a portion of the article from the *Times* of 1881.

> The method of trephining the skull with the surgical engine of Bonwill, which I believe to be the only one sufficiently powerful, would then be as follows: Pick out a burr one-fourth or three-eighths of an inch in diameter, well tempered, and having a flat face deeply cut; then fixing it in the mandril, close up to the hand-piece, have the engine-crank turned with great rapidity. When the skin and periosteum have been dissected up, apply the burr to the sound bone nearest the *most* depressed portion of the fracture, and at first tilt the burr a little on the edge until a shallow groove has been made on one side of the proposed perforation. This prevents the burr slipping from the smooth convex cranium. Keep the burr constantly moistened by means of a wet sponge held over it and occasionally squeezed. When the perforation has been made, use the elevator as in ordinary trephining. If there is difficulty in elevating or removing the fragments, cut away with the burr the edges which cause locking. Hey's saw or bone-cutting forceps will not be required.
>
> The ordinary burr furnished by makers of the engine is sufficient, but the face could with advantage, I think, be cut deeper. Instead of the ordinary burr the central portion of the face might be bored out, leaving then a burr that would remove a disk such as the ordinary trephine does, and which might also be made conical. These changes, however, would be of doubtful advantage, though I shall probably experiment with this form of burr.
>
> The use of the surgical engine for perforating the cranium is, as far as I know, novel, but it is very possible that others may have experimented on the cadaver or living subject and found similar results.

Later I had a small trephine without a center pin made by the dental instrument maker, but never used it on a patient. I found that the surgical engine, as then constructed, was not convenient for general surgical work. It required too much adjustment to be immediately ready for emergency surgical operations. At that distant time, electric lights and electric motors were not at hand as they are now; and the surgical engine with cable was a poor thing compared with that in use today. I have not yet found my old flat burr, but here is the little trephine made in the winter of 1881–82 still sharp, still unrusted. It was brought into active service a few days ago, when Masland and I wished to use it in connection with his efficient saw. It bored with youthful energy the two holes in the parietal region, needed for the introduction of his dural separator, prior to his accurate construction of an

osteoplastic trap door for exposing the middle meningeal artery. It proved pretty conclusively that it would be as safe, rapid, efficient and satisfactory for perforating the cranium as is a sharp scalpel for opening the abdomen. It seems to me to make the flat or fissure burr unnecessary, though that could be readily used instead of the trephine.

The advantages of the electrically driven burr or trephine over some of the more recent instruments for penetrating the skull are its simplicity and inexpensiveness. It needs merely to be attached to the mandril of any surgical engine, run by hand, foot or electric power, used for drilling bone. The Gigli wire saw, the Masland saw or any other means of making bone flaps or grafts, which requires a preliminary hole of entrance, are available after the trephine opening is made with my burr or trephine. It is probable that many surgeons now use electrically driven trephines. I mention my early experiments because such attempts have historical interest. When I devised an aseptic hand trephine, which was used a good deal some years ago, and had constructed the segment trephine for making large openings in the cranium, the initial steps were being taken by Keen, Briggs, Bergmann, Cushing and others which have borne such wonderful fruit in the domain of cerebral surgery.

When President William T. Briggs appointed me to open a discussion on brain surgery before this Association in 1885, I introduced in the title of my paper the word "Limitation." Notwithstanding that qualification, I was considered a foolhardy youngster who weighed not his words. Now, my juniors are teaching us how few are the limitations in operative surgery of the human brain.

THE APPLICATION OF THE TEACHINGS OF WAR SURGERY TO CIVIL HOSPITAL CONDITIONS[1]

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THE war has emphasized many facts, a careful consideration of which should prove of value in connection with surgery in civil hospitals. One group of facts has to do with the general organization of our hospitals, another with the pathology, bacteriology and treatment of traumatic and infectious processes. We present certain aspects of both groups for consideration.

The war had been in progress but a few weeks, when it was amply demonstrated that all previous training of surgeons had left them hopelessly deficient in the knowledge of wound processes. Conditions strikingly similar to those present in our Civil War were developing. To quote Moynihan:[1] "Suddenly the surgeon was confronted with a large succession of cases in which a raging, and often a rancid suppuration was present, and he found that all the old remedies upon which he had so comfortably and confidently relied, were hopelessly inadequate and futile. A challenge was, so to say, thrown to the profession, and I think we may now, with due modesty, claim that it has been splendidly and triumphantly met. Rebukes and taunts at our incompetence were not seldom heard in those far off days." It is not unfair to say that these rebukes were, to a certain extent, deserved, in that surgery had neglected one of its opportunities. The development of aseptic surgery following the teachings of Lister and Pasteur was so rapid, the advance of the operative field into the abdomen,

[1] Treatment of gunshot wounds. Surg., Gynec. & Obst., 1917, xxv, 583.

[1] Read before the American Surgical Association, Cincinnati, June 6, 1918.

the cranium and the thorax held out such enticing promise; the work entailed was so clean cut, so attractive and so productive, that the best minds were centered on it. The less congenial, less striking, and less comprehended field, of badly traumatized and badly infected tissues, was overlooked. There was no general grasp of the fact that such cases were appallingly plentiful in civil life, and that they occurred to a great extent in patients in the prime of their productive life. Their care was relegated to a secondary place, and the custom of considering them as the especial responsibility of the junior members of the visiting staff, or even the house staff, while not universal, was more or less general. This resulted in a perfunctory routine treatment, founded in most instances upon incomplete pathological and bacteriological knowledge. A tradition gradually developed that these cases at best must terminate in some degree of permanent disability and that no form of treatment would appreciably improve the results. In time the junior surgeons passed from what the majority of them found uncongenial work, and entered more and more into the competitive field of major operative surgery. The surgeon, thus untrained in this type of work, reached the period of his greatest productivity, but no longer had occasion to apply his developing powers of sound judgment to the class of cases which constitutes the vast majority of war casualties.

Under such conditions it is not surprising that the war found the surgeons unable to cope with its horrors. The older men were confronted with a disease process to which they had given no consideration for many years. And the younger men suddenly found themselves overwhelmed with this thing which they either had put behind them, or soon hoped to. We cannot help feeling that our lack of foresight merits a reproof.

Has there been any lack of opportunity during the past thirty years to have learned many of the lessons that the war has taught? Could we not have fathomed more of the secrets of wound infection and healing? Has a compound fracture been such a rare thing that more knowledge expressed in an authoritative way has been an impossibility? Answers to these questions must indicate a failure to have profited by our opportunities. The defect has lain in that there has not been sufficient insistence on and striving after an improvement, the need for which has been strongly or dimly felt by all the thinking members of the profession. The needed improvement is along the line of a definite reorganization of our entire hospital plan. The war has now demonstrated, so that all may comprehend, how this should be accomplished. If, as Moynihan says, the surgeons have triumphantly met the challenge thrown to them, there has been one all-important factor in their ability to do so.

The military situation makes it possible for the surgeon to call to his aid physicists, chemists, pathologists, and bacteriologists. He is not dependent upon a casual contact with the trained minds of those men who have formerly been so content to expend their intellectual force upon abstract scientific problems, the benefit of which he, as the clinician, was expected to apply to disease processes, without help. Actually to see, to feel, and to know the bedside problems was to them a matter of little importance, a field scant in fruit, and in the opinion of some, beneath the dignity of a highly trained scientific mind. If the clinician did not find the time to make his home in the laboratory as well as in the ward and operating room, he was considered of inferior caste, yet the laboratory workers showed no inclination to come to the surgeon. How earnestly and futilely have we invited, urged, and cajoled the well-trained men of our laboratories to come to our wards and operating rooms and give us the aid their training entitled us to expect from them, and by first hand observation see the difficulties with which we were confronted. These confrères sent us a pathological interne who entirely satisfied them by bearing culture tubes and surgical specimens to the laboratory to receive routine treatment without regard to the great underlying clinical and pathological principles.

Surgeons have felt the hopelessness of such a situation, and individuals have made successful efforts to obviate it, by having a ward

pathologist and bacteriologist attached directly to the clinical staff. These, however, were young men with limited experience, and could not bring to the study of the clinical problem a sound judgment, founded on a long experience in a laboratory closely related to clinical study.

The war has demonstrated beyond further debate that corresponding progress will only be made in our civil hospitals if the patient is made the center of all its activities. The wards and operating room must have a staff of laboratory men just as they have a staff of surgeons. The art of surgery and the sciences on which it is founded cannot be compassed by the mind of one man. The laboratory scientist will be more productive by close contact with the surgeon, and the surgeon will profit equally. Both of these staffs must be composed largely of full time men. Our military surgeons and laboratory men find no distracting calls outside the hospital. No one can conceive that the advance made in three years could have been possible, if the best trained minds had spent three or four hours a day at the hospital, and then left them to get on as best they might during the remaining twenty hours under the sole care of juniors and internes. It may be argued that to organize our hospitals on such lines will prove financially impossible. Such argument cannot be maintained. Money has always been forthcoming to foster any well thought out plan, for the betterment of education, and the best care of the sick and injured. Had the lessons in the treatment of the injured which this war is teaching, been in force during the past two decades, the money saved to our industries would more than have met the expense involved in having learned them. The duty of spreading this teaching lies with our profession, and upon our success depends our ability to give to the country one of the offsetting benefits with which war, to some extent, balances its horrors. Another more easily accomplished phase of organization has also been placed in evidence in the military hospital. Every service has had at its disposal well trained mechanics and carpenters. Most surgeons in civil hospitals have vainly struggled to get a simple piece of apparatus constructed to meet some special requirement. There was no well

TABLE I. COMPARISON BETWEEN THE ORGANIZATION AND PROFESSIONAL ACTIVITIES OF CIVIL AND MILITARY HOSPITALS

MILITARY HOSPITAL	CIVIL HOSPITAL
One commanding medical officer whose authority, under army regulations, is supreme	No such officer, whose authority can be exerted in a correspondingly efficient manner.
All members of the staff are on a "full time" basis, and give their undivided attention to the work within the hospital	In most instances none or but few of the members of the staff, other than the house officers, are on a "full time" basis.
Absolute correlation of all departments and activities, with the object of returning the patient to duty at the earliest possible moment.	No close correlation between the several departments, administrative, clinical and laboratory; each department being independent of the others, instead of responsible to one supreme commanding officer.
Each department a dependent means to the end of securing the greatest benefit for the individual patient.	Each department an independent unit, concerned more with its own problems than with a mutual co-operation in the solving of common problems.
Within each department, all strictly departmental policy is controlled by the chief, with the approval of the commanding officer.	This does not obtain in most hospitals, and is absolutely lacking where a rotating service exists.
Military medical organizations must receive and care for all cases coming to them, and can only be relieved through the regular channels of evacuation or by the termination of the case in cure or death.	Civil hospitals may or may not accept a patient for treatment depending on the type of case, thus delaying the initiation of adequate treatment.
Incoming patients are seen by an officer of mature judgment who is capable of making such immediate disposition of the case as will best meet the needs of the patient.	Incoming patients, even when in serious condition, usually seen by a house officer of immature judgment who carries no power to initiate definitive treatment.
The chiefs of the services or fully qualified associates are always on duty, prepared to take immediate action when required.	Except during hours of "rounds" emergency cases must await the arrival of a qualified member of the visiting staff or accept inadequate treatment.
Laboratory examinations, including X-ray, may be made immediately on admission, while patient is en route to the ward, thus saving hours or even days, and assuring a minimum of handling of case.	These examinations are ordinarily not made until after patient has reached the ward and requests have been made through elaborate channels, involving loss of time and additional handling of patient.
The laboratories, including X-ray, are available at any hour of the day or night, and have a staff of assistants adequate for the heavy work they must perform.	Laboratories, including X-ray, available only during specified hours or days, and usually understaffed for the work to be performed.
The clinicians are assisted by a staff of trained mechanics, who are able to prepare or devise apparatus for the treatment of fractures, etc.	Rarely are trained mechanics associated with the hospital for the purpose of manufacturing apparatus for patients.
The patients must be held in hospital, or evacuated to an equally competent hospital until all wounds are healed, and the patient is fully able to return to his duty.	Too great a tendency to the early discharge of cases, in order to secure beds in an overcrowded, inelastic system, and failure of the outpatient department to exercise an adequate control over the discharged patient.

equipped shop at hand with a competent workman who could promptly furnish the apparatus, and at the same time, suggest ways of meeting mechanical problems for which his training fitted him. Trustees of hospitals have been very loath to recognize that other artisans than surgeons might be advantageously employed in a surgical service. The results abroad should be very effective in convincing them that this view is no longer tenable.

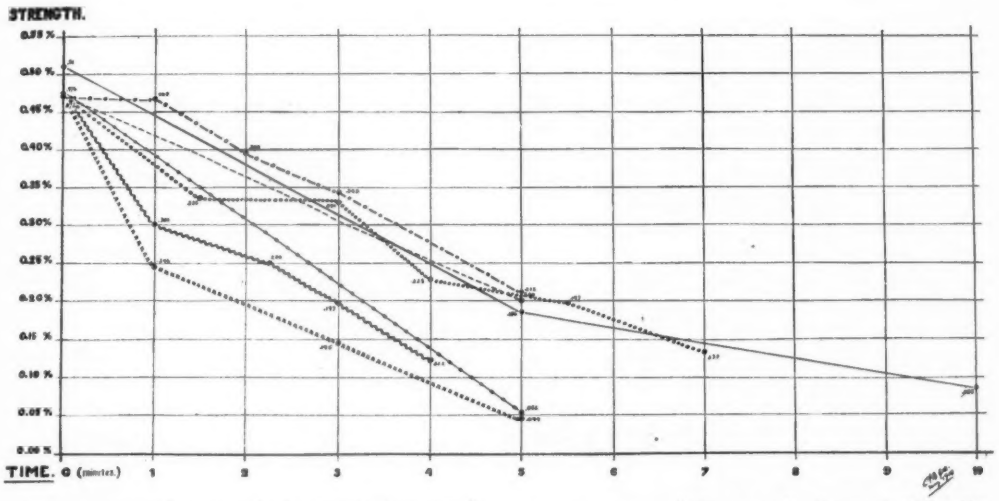
Table I contrasts civil and military hospitals, and suggests the lines along which reorganization should take place. Taking advantage of the opportunities above discussed, which a well organized Army Medical Corps gave to them, the English and French used the enormous number of wounded coming under their care to master speedily some of the principles underlying the treatment of war injuries. The application of these lessons to our work in Bellevue Hospital, where there exists a large traumatic and infected service, constitutes the second point which we desire to discuss.

Four definite principles may be accepted as having been established. First, severe traumata, badly contaminated with bacteria, need not go on to active infection and suppuration. Second, these sequelæ are largely the result of certain physical as well as biological factors. Third, if these sequelæ do supervene, they may be largely controlled by removal of physical factors, rather than by killing the bacteria. Fourth,— a seeming paradox — aseptic surgery is not confined to clean operative wounds made through carefully prepared tissues. To test the applicability of these principles, we utilized assignment by the Office of the Surgeon General to give a course of instruction in fractures and war surgery at the Cornell Medical College and Bellevue Hospital. All traumatic cases and all important infected cases were made a special service. The number at our disposal was on an average between thirty and forty. The range of cases was large, and during the seven months the work has been in progress there has been sufficient of each type to permit of rather definite conclusion. We had associated with us the heads of the departments of chemistry, pathology, bacteriology, physiology and anatomy, and being bound together by the common interest of teaching medical officers the work was from the start closely correlated; thus, to some extent, giving us a semimilitary organization. For a point of departure we selected a study of the chlorine antiseptics.

Our first concern was to establish our practice exactly on the lines taught by Carrel, DePage, Dehelly, Dakin, Dunham, Daufresne, Lee, Furniss, and others who have had the imagination to conceive and the patience to develop new procedures. Following closely the writings of these men, and the practical experience of one of us (E. F. B.) at the Rockefeller War Hospital, we had little difficulty in perfecting a smoothly running service in a few weeks.

Every detail of the Carrel-Dakin method with the sodium hypochlorite was observed, and the method as described by Lee, Furniss, Sweet, and others for the dichloramine-T, received equally close attention. We had no difficulty in practically eliminating pus from the wards, and with a few notable exceptions, the worst suppuration could be controlled in a short time. Immediately the question arose as to whether the results obtained were due to the more intensive care and study, or to some inherent value in the various steps followed. Undoubtedly the former is an important factor, but after seven months' very close observation and analysis, we have concluded beyond question that the treatment of most suppuration is definitely improved by the employment of the hypochlorite solution. We, however, are not prepared to accept the hypothesis that its greatest value is its bactericidal power. This property is a definite aid in efficiency, but in another more important attribute lies its greatest virtue.

Sodium hypochlorite in a watery solution of 0.45 per cent to 0.5 per cent — the limits prescribed by Dakin — is strongly proteolytic. It is more potent in digesting protein in dead form than in the form of living protoplasm, though it can undoubtedly attack the latter. The splitting action is brought about by an interchange of the "active chlorine"



1. ———— Jan. 17, 1918. Large nephrectomy wound with fæcal fistula. Moderate soiling with fæces.

2. —•—•—•—•—•— February 25, 1918. Same wound as *1*. More soiled with fæces than in *1*. All traces of "active chlorine" gone in 50 minutes.

3. - - - - - - - - - - March 28, 1918. Carbuncle of neck. Slight necrotic tissue still present. All traces of "active chlorine" gone in 1 hour and 20 minutes.

4. •—•—•—•—•—• April 25, 1918. Abscess of thigh. Old wound, clean, covered with healthy granulations.

5. •••••••••••••• April 25, 1918. Empyema, right pleural cavity. Readings made at operation.

6. xxxxxxxxxxxxxxxx May 22, 1918. Empyema, right pleural cavity. Readings made 24 hours after operation.

7. ~~~~~~~~~~ May 22, 1918. Empyema, same as *6*. Reading made immediately after *6*.

Chart 1. Fall of strength of Dakin's solution in wounds.

Curves 1 and 2 were made from the same wound on different dates. At the second reading the wound was much dirtier, and there was more material within it with which the Dakin solution could react, and the fall of strength has accordingly been more rapid.

Curve 3 The fall in a comparatively clean wound.

Curve 4 also represents the fall in a very clean wound, in which there was little exudate. It will be noticed that the fall in strength during the first minute was negligible. Thereafter when the exudate was poured out from the walls of the wound, the fall followed the rate noted in the other wounds.

Curve 5 was made from a wound which had just been flushed with Dakin solution, and therefore a considerable amount of the purulent exudate had already been washed out of this cavity.

Curves 6 and 7 were made from the same wound.

Curve 6 was made without any prior flushing of the empyema cavity.

Curve 7 was made as a second reading from the empyema cavity, which had already been flushed once and in this second reading the fall in strength was not so rapid as in the first reading when the cavity still contained a small amount of unchanged exudate.

in the hypochlorite solution, and the hydrogen in the amino group of the protein. A chloramine first forms and then a dichloramine. The reaction probably does not stop here and a further substitution of chlorine takes place. The exact nature of this latter stage is not, as yet, established. The products, however, become more and more soluble and in this there exists a very definite advantage.

The reaction is in no sense specific. The protoplasm of bacteria is attacked with no more avidity than is that of the protein on which the bacteria live. The living human tissue has, however, a strong defense against digestion. When the hypochlorite solution comes into contact with it, an immediate response is the outpouring of tissue fluids containing an abundance of protein in solution. This dissolved protein at once takes up the available chlorine, and in less than one minute the hypochlorite falls below the Dakin strength, and in the conditions ordinarily obtaining in its therapeutic use, a negligible amount of available chlorine is found at the end of ten to fifteen minutes.

The accompanying chart illustrates this as determined in various types of pathological

lesions (Chart 1). If the wound under treatment contains an abundance of bacteria, more or less destroyed leucocytes and inflammatory débris, the first reaction is with these substances, rather than with the tissue fluids freshly poured out. Thus the bacteria are killed, the necrotic material is dissolved, and the surface of the wound becomes clean. If, on the other hand, the test is made with an already perfectly clean, granulating surface, there is less immediately available protein, and the hypochlorite strength is less rapidly, though markedly, lowered. It is interesting to note that for this reason, skin irritation very rarely takes place around wounds of the former class, even though no particular attention is paid to its prevention. On the other hand, when a wound is nearly, or quite clean, and the less changed solution flows over the skin, an irritation will take place unless the skin is protected. Knowledge of this fact is helpful in doing the dressings, because only when the acute suppurative stage of the wound has been controlled, does one need to watch all the detail of skin protection. Another observation in this connection is of interest. Unless the amount of Dakin solution is in great excess, skin burns always remain very superficial. The explanation lies again in the fact, which we desire to emphasize, namely, that Dakin solution, in contact with any body fluids ceases almost immediately to be Dakin solution. The superficial burn pours out albuminous fluids, hence the solution immediately loses its power to burn.

Early in our experience we encountered a case, which, at that time, baffled our attempts to explain the sequence of events. With our present conception of the problem, the explanation is forthcoming:

The patient was admitted with his arm torn, crushed, and fractured beyond possible repair. He refused amputation for more than forty-eight hours, by which time, complete gangrene and a high grade of infection had developed. Disarticulation at the shoulder joint was done, and treatment with hypochlorite solution immediately instituted. The suppuration was promptly controlled, except that a little pus could always be found deep in the wound at the glenoid fossa. This was never more than a few drops, but it served to keep the bacterial count high, and delayed the final healing of the wound. One tube was regularly led to this point, and the fossa was kept intermittently bathed in fresh solution. Investigation by opening the healing wound showed a necrosis of the glenoid cartilage. This poorly nourished tissue was not able to throw out sufficient fluid to neutralize the full strength hypochlorite poured upon it, and hence was itself destroyed. Removal of the cartilage and bathing of the more vascular bone resulted in a prompt healing with complete closure of the wound. Had we fully comprehended this fact, and protected the cartilage with the vaseline mixture as we protect the skin, the healing process would have been much hastened, and the cartilage would have lived.

This experience with our misconception of its nature led us to believe that Dakin solution should not be used in joint cavities nor in contact with tendons and other lowly vascularized tissues. Therefore, when a patient presented himself with a badly infected knee-joint, showing a streptococcus, we opened it by two lateral and two posterior incisions, applied traction and washed the joint intermittently with ether or normal saline solution. His progress was distinctly bad. The suppuration burrowed, the knee condition became more and more advanced, and resection or even amputation seemed our only resource. Arguing that in any case the knee would have to be sacrificed, and the hypochlorite would do no worse, its use was instituted. Suppuration was controlled very promptly, the joint cavity cleaned up, extension lines down the leg and up the thigh showed healthy granulations, and the final result is a knee-joint far from useless. It was this unexpected result, when compared with the necrosis of the glenoid, which brought out the fact that cartilage and synovial membrane already the seat of severe inflammation by infection, will not be damaged by hypochlorite. The hypochlorite attacks, and is chemically satisfied by the products of this inflammation and the joint structures are aided by its action. The rule is thus formulated that recently injured joints in which suppuration has not taken place, should not be exposed to hypochlorite. The response in tissue fluids may not be sufficient to protect joint structures from erosion. On the other hand, a joint already infected and filled with purulent exudate, may, and should be, so treated, because the damaging tissue will be

digested away, and the joint cavity returned to a more normal condition. Sound judgment must determine the degree of infection which should or should not be irrigated, the placing of the tubes within the joint, the amount of irrigation, and the period at which it should be discontinued.

Our ideas as to the treatment of empyema have undergone an evolution similar to that for joint infections. Appreciating that the hypochlorite solution is very destructive to the peritoneum, pleura, and endothelial membranes in general, we at first scrupulously avoided using it in the pleural cavity. The non-digesting chloramine solution 0.5 to 1 per cent was substituted in some cases. While this exerted a beneficial influence in changing the discharge from a purely purulent character to the less offensive mucilaginous type, it did not seem to hasten healing.

Reports came to us that other hospitals were boldly using hypochlorite solution, even going so far as to fill the cavity after evacuating the pus through a rib resection and plugging the opening in order to get the solution in contact with every part by exerting gravity pressure. These experiments were watched with interest, but our understanding of the processes involved was too meager to permit emulation of this courageous procedure. As the true properties of Dakin solution unfolded themselves, and we fully grasped the fact that contact with purulent material almost instantly destroyed its digestive power *in vivo* as well as *in vitro*, we felt willing to investigate the subject by actual clinical means. The chart, already presented, shows the results. The only possible damage can result when full strength Dakin solution comes in contact with an unaltered plural surface. As this is hardly conceivable, if caution is used in avoiding pressure, we arrived at the conclusion that the Carrel-Dakin method is applicable to the treatment of empyema.

Since, however, fluid put into the cavity under pressure may very readily force its way beyond the infected portion and gain entrance into portions of the cavity possessing normal pleura, we deprecate its use in this way. A second determining factor in this conclusion is also found in the well-known fact that irrigation of an empyema cavity under pressure with any fluid, has, in the past, caused many cases of alarming collapse, and even death. The reason for this, so far as we have been able to learn, is problematical, but the danger is none the less real. Our later practice, therefore, has been to perform the usual rib resection under local anæsthesia, evacuate the pus, and so far as possible, remove all gross coagula of lymph. Tubes are then inserted and with the patient so placed that an easy egress of the fluid is maintained, Dakin solution is slowly run into the cavity under low pressure. Any violent coughing or embarrassment of respiration or pulse is a signal to stop the procedure. Hourly, or two hourly irrigations are instituted, the amount being regulated so that each irrigation washes out all that remains of the preceding, and fills the cavity with fresh solution, due attention always being paid to avoiding overdistention.

Our experience leads us to believe that in this method an advance in the care of empyema has been made. The patients convalesce more rapidly, the purulent discharge ceases sooner, and secondary pocketing is less frequent. In no case, however, have we duplicated the results reported to have been obtained in some clinics, wherein well developed empyemata have been rendered surgically clean in five to nine days, with secondary suture of the chest wall resulting in complete healing.[1]

We have not thought it necessary before this gathering to emphasize the fact that in all our work we have done our utmost to insist on the well established principles of surgical procedure in infected processes. Surgical incision in every instance takes precedence over all else. Ample drainage is never neglected. No line of reasoning based either on our own experience or on the teaching of others has led us to accept the idea that hypochlorite acts better in puddles, than in a properly arranged irrigation with drainage. We only puddle when it cannot be avoided surgically.

[1] Since presenting this paper such results have been obtained in our clinic also.

To sum up our studies in the mode of action of Dakin solution, we believe it possesses three important properties:

1. It is a powerful digestant of protein substances.

2. This includes the protein of bacteria, hence it is a bactericide.

3. It stimulates wound surfaces to pour out albuminous materials and leucocytes, hence it still further destroys bacteria.

These three properties combined give it its undoubted power to clean the surface of infected, suppurating wounds. In our experience we find its proteolytic power more important than its purely bactericidal. Hence its greatest use is in wounds in which suppuration is well established and an abundance of more or less devitalized necrotic tissue is present.

A full realization of these conceptions clears away much of the misunderstanding that has been prevalent concerning the use of Dakin solution, and answers the charge against it, that not being specific for bacteria, any such powerful bactericide must necessarily be destructive of living body tissue, and thus destroy body defenses. On the contrary it destroys the bacteria and at the same time draws out locally the body defenses.

This understanding of the action of sodium hypochlorite has proved most helpful to us in applying it to our cases and in determining its field of usefulness and its limitations. In the last analysis, the healing of any wound, whether clean or infected, is a property of the tissue involved plus the general physiological activities of the whole body. If those be deficient, either inherently or relatively as compared to the virulence of infecting organism, the infection cannot be controlled, no matter what form of antiseptic or physiological treatment is applied. This is amply demonstrated by one case suffering from a severe thigh infection with a virulent streptococcus. The local suppuration was easily brought under control, but the patient died from a streptococcæmia with positive blood cultures. Anderson and Richardson[1] report a similar case in which this was the final cryptic note on the chart: "Wound almost healed, patient dying." Again we can cite cases in which the local condition progressed satisfactorily, though not ideally, and metastatic infection developed in distant parts, the same organism being present as that found in the original wound. Blood cultures in these cases were negative.

These considerations further lead one to the conclusion that Dakin solution is not indicated in cleanly traumatized tissues. When, therefore, a recently wounded patient can be adequately treated by the now established procedure of thorough mechanical cleansing and a careful complete excision of all damaged tissue and foreign materials introduced, it is supererogation to apply Dakin solution. The tissues are able to cope with any remaining bacteria successfully, and one is dealing practically with the condition found in a surgical wound made under the usual operating technique. Primary suture may be done with a strong hope that primary union will result. This, in war conditions has been realized in from 80 to 95 per cent of the cases. In civil conditions we find this is hardly to be expected, because the crushing, tearing, injuries inflicted by machinery and run over accidents are often more extensive even than those caused by war missiles. Care in selecting the cases has, however, demonstrated to us that primary union can be more often expected than heretofore had been believed.

Under all conditions, however, where this is sought for, there will be a certain percentage of failures, and active suppurations will supervene. Nothing of which we have any knowledge is then so efficient as Dakin solution in controlling this complication, and restoring the wound rapidly to a condition where secondary suture may be successfully done.

Moynihan, in discussing the relative merits of the Carrel-Dakin treatment and primary closure of recent wounds, after careful mechanical cleansing and efficient surgery, states that the results are about equal. He adds: "To put this statement in what may seem an extreme fashion, it may be said that the

[1] Septicæmia as a complication of gunshot wounds. Brit. J. Surg., vol. v. 393.

Carrel-Dakin method achieved its greatest triumph in cases where it need not, in fact, have been applied." This does not imply, as might be inferred, that the method is without value. It simply means that this method is not called for in recent wounds, i.e. six or eight hours after injury — those which are contaminated only but in which the contamination has not developed to an actively growing infection or suppuration. Of the treatment for the latter condition, Moynihan speaks with enthusiasm, and says, "pride of place will cheerfully and gratefully be given to the Carrel-Dakin procedure." In an analysis of the entire subject he then presents very much the views herein developed. To his teaching, and to that of Morgan, Saner and Schlesinger[1] we are greatly indebted. They have been invaluable in helping us to arrive at what we find a most satisfactory working knowledge of this complex subject. These authors have given us a clear cut conception, largely lacking in the mass of literature which has appeared in the past two years.

The use of dichloramine-T has been given as thorough a study during the seven months as has the hypochlorite solution. It has not proved so efficient. It lacks the very element, which makes the hypoclorite solution potent, namely, any appreciable proteolytic power. It will act as a bactericide on wound surfaces, but more than this is needed. Even in this respect it has proved disappointing as compared to the more active chlorinizing agent. Many wounds kept clean on the surface with hypochlorite prompt y showed a higher bacterial count under the use of the dichloramine.

[1] Some aspects of the treatment of infected war wounds. Brit. J. Surg., vol. v, 425.

CONCLUSIONS

In conclusion we desire to emphasize the two points which a study of war conditions has made applicable to our work in a civil hospital.

1. It has enabled us to get a very close co-operation between our forces and those ordinarily fully occupied in laboratory work. The practical benefit accruing to the wounded has demonstrated to laboratory men that they have an immediate responsibility in applying their knowledge to clinical problems. This responsibility they have accepted with a helpful enthusiasm which heretofore we have failed to arouse. Our studies could not have been productive without their aid. One immediate result of this co-operation has been the development by Stanley Benedict, Professor of Chemistry, Cornell Medical College, of a simple, cheap and efficient method of preparing Dakin solution.[1] To him we are indebted for having always on hand an absolutely reliable, standard hypochlorite solution. Any questions as to its correct composition were immediately answered in an authoritative way.

2. We have found in the study of traumata, infections, and suppurations a field heretofore little cultivated, rich in interest, and yielding a return in actual service rendered to the patients, hardly exceeded by any branch of surgery within our experience.

We are fully satisfied that by applying the teachings of military surgery to these conditions, a definite advance has been made in their treatment.

[1] See article by Stanley R. Benedict, "Preparation of Dakin's Solution from Liquid Chlorine by the Gravimetric Method," on pages immediately following.

PREPARATION OF DAKIN'S SOLUTION FROM LIQUID CHLORINE BY THE GRAVIMETRIC METHOD[1]

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THE best theoretical method for the preparation of sodium hypochlorite solution of known strength is to pass a weighed quantity of chlorine gas into a solution of sodium carbonate. The reaction proceeds as follows:

$Na_2CO_3 + 2Cl = NaClO + NaCl + CO_2$.

Weighing the chlorine used is preferable to attempting its measurement by volume for the following reasons:

1. Greater accuracy, since volume of chlorine gas is subject to change from temperature and atmospheric pressure changes.

2. The apparatus required for weighing the chlorine is less complicated, less readily broken, and cheaper than that required for the vo ume-measurement of chlorine.

3. The process of weighing is more rapid and convenient than measuring the gas.

The following is the procedure for the preparation of ten litres of Dakin's solution by the gravimetric method.

Apparatus and solutions required:

1. A torsion balance, capacity to ten pounds, sensitive to about 0.2 grams. (Cost about $40.00.)
2. Two one-litre Florence flasks.
3. A Folin or other suitable absorption bulb.
4. A tall-form absorption bottle of about 100 cubic centimeters capacity.
5. A 20 per cent solution of anhydrous sodium carbonate.
6. A 10 per cent solution of crude caustic soda.
7. A small calcium chloride drying tube.
8. Suitable rubber tubing (a few feet of thick walled tubing).
9. A cylinder of liquid chlorine.

Procedure. The cylinder of chlorine is connected to the calcium chloride tube with rubber tubing. The other end of the tube is connected with a piece of narrow bore, heavy walled tubing about three feet in length. About a foot from the end this tube should reach over the balance, with a suitable support to hold it at about the height of the first absorption flask, and so adjusted as to prevent the tube from slipping in either direction. Into one of the Florence flasks is placed 900 cubic centimeters of the 20 per cent carbonate solution (the solution can be prepared without undue exactness, and can be measured in an ordinary graduate). This flask is fitted with a two-holed rubber stopper, through one hole of which passes the Folin absorption bulb, bent at right angles at the top. Through the other hole passes a short outlet tube, also bent at right angles. The flask is placed on the balance, and the inlet tube connected with the rubber tube from the calcium chloride tube. The outlet tube is connected by means of a short piece of thick walled tubing to the inlet tube of the small absorption bottle, which should contain about 90 cubic centimeters of 10 per cent NaOH, and which is placed on the same pan of the balance with the Florence flask containing the carbonate. (The function of this second absorption bottle is to retain the carbon dioxide which is liberated during the action of the chlorine. Unless this gas is retained it would ultimately be weighed as chlorine.) The second Florence flask (which should have a stopper provided for it) is placed on the other pan of the balance, after having been about half-filled with sand or other heavy material. The stopper for this flask is also placed on the pan, and water added to the flask until the two flasks counterbalance practically exactly. With a little practice this counterbalancing requires only a moment or two. Weights amounting to exactly 43.0 grams are then placed on the pan with the second flask, and chlorine gas is passed into the first flask until the two flasks come to a balance, i.e., until 43.0 grams of chlorine have been added to the first flask. The chlorine should be bubbled into the first flask at such a rate that not less than 20, or more than 30, minutes are required for the passage of the 43.0 grams. After the chlorine has been passed in, the flask is disconnected from the inlet tube and from the second absorption bottle and the contents are diluted

[1]For further details see article by Hartwell and Butler, "The Application of the Teachings of War Surgery to Civil Hospital Conditions" on pages immediately preceding.

to ten litres with tap water, taking care to wash the absorption bulb and the inside of the flask thoroughly during the dilution to ten litres.

NOTE. — The method may be employed to advantage for the preparation of five to twenty litres of Dakin's solution at one time, changing the constituents used in proportion to the final dilution. The weight of chlorine used is slightly below theoretical, this being accounted for by the loss of a small amount of carbon dioxide, in spite of the absorber. About 500 to 700 litres of solution have already been prepared by the above method. Never has a correction in reaction (alkalinity) had to be made, and in only one trial was a correction necessary for the hypochlorite content. This latter ranges practically invariably between 0.46 and 0.49 per cent of NaClO.

RECONSTRUCTION AND REPAIR OF THE HEPATIC AND COMMON BILE-DUCTS

IMPLANTATION OF THE HEPATIC DUCT INTO THE DUODENUM

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PAPERS concerning restoration of the bile passages have appeared with increasing frequency of late. Surgical opinion is crystallizing as regards the best indicated procedures, but there is still something to be learned from the individual case report.

Mayo (1) quotes Jacobson (2) to the effect that injuries to the common and hepatic ducts are usually due to operative trauma. Phemister (3) believes that such accidents are rather frequent and states that Kehr (4) reports sixteen injuries to the hepatic duct during one thousand cholecystectomies. The technique of cholecystectomy, as evolved by Judd (5), Deaver (6), Guthrie (7), and Seelig (8), and the reference of Mayo to the anatomical relations of the gall bladder and ducts, uniformly emphasize the safe isolation and section of the cystic duct and artery.

Obstruction may sometimes occur, according to Mayo, as a result of cicatricial contraction following gall-stone ulceration. This occlusion is due to stones impacted in the cystic duct at its junction with the common duct rather than to stones in the free part of the common duct itself. Ulceration and stricture do result, however, from stones lodged in the pancreatic portion of the duct. Obstruction of the common duct has also been caused in two instances at the Mayo clinic by the pressure of a benign tumor of the stump of the cystic duct following cholecystectomy. Removal of the tumor and the stump of the cystic duct was curative.

Walton (9) describes some of the earlier efforts to establish communication between the liver and the duodenum without reconstructure of the common bile duct. They were fantastically ingenious rather than practical.

The procedures, described inadequately here, which have been utilized in the Mayo clinic for the restoration of continuity in the bile passages are:

1. Excision or resection of the obstructed portion of the common duct with end-to-end union. Such resections require exact technique. The open end of the common duct is split along the anterior surface for one third of an inch to facilitate coaptation to the dilated hepatic duct. A "T" tube is introduced and the suture line reinforced by omentum or peritoneum as available. The "T" tube is removed in three weeks.

2. Strictured area of the common duct divulsed with dilating forceps. When the stricture resulting from ulceration is in the pancreatic portion of the duct, it may be dilated with forceps introduced through an opening in the duct, or it may be necessary to open the duodenum and expose the papilla before attempting divulsion. After divulsion a "T" tube is placed in the duct.

3. Extensive injuries to the great bile duct necessitating union of the hepatic duct

to the duodenum. The first case operated upon by this method in the Mayo clinic was reported in 1905 (10), and the patient is well after more than ten years. The union of the dilated hepatic duct and the duodenum may be accomplished by a two-row suture anastomosis similar to a gastro-enterostomy and the suture line protected by omentum. In one case a shrunken gall bladder was used to bridge a defect and in another instance a pedunculated flap of the duodenum was utilized as suggested by Walton.

Union of the common or hepatic duct to the duodenum may also be effected by a modification of the Sullivan method which is described in detail as follows: "The hepatic duct is united as well as possible by a muco-mucous suture to an opening made into the duodenum and a rubber tube introduced and sutured into position. The suture is continued in a manner so that at least some portion of the new canal may be mucus-lined. The line of union is, of course, not bile-tight, but by surrounding it with omentum it does not seem to leak into the peritoneal cavity. The tube extends into the hepatic duct to the primary division and about one inch into the duodenum."

4. Direct union of the common duct to the duodenum has been carried out several times at the Mayo clinic following resection of the common duct for cancer and once after partial gastrectomy for cancer of the pyloric end of the stomach. The results have been disappointing.

The writer's case is as follows:

History. Mrs. B., age 34 years, the mother of five children, had a cholecystectomy performed for non-calculous cholecystitis, on May 2, 1917. At this time her weight was 122 pounds. On the tenth postoperative day a biliary fistula developed and the stools became clay colored. On two subsequent occasions the external opening has closed and abdominal pain and elevation of temperature have necessitated re-establishment of the fistula. It is evident that all the bile is draining onto the skin since the stools remain persistently colorless. Jaundice has varied in degree. On August 23, 1917, Mrs B. was referred to the writer for operation. At this time the weight was 85 pounds, jaundice was marked, and bile drainage rather free.

Operation. Entrance to the abdomen was made mediad to the former incision as advised by Mayo. The first portion of the duodenum was so firmly adherent to the abdominal wall that the serous coat of the bowel was damaged in freeing it. Repair was made with chromic catgut. Adhesions between the liver and the peritoneum were divided. Extensive adhesions throughout this region had destroyed the anatomic relations, and venous oozing obscured the the field. Eventually the gastrohepatic omentum was isolated and the hepatic duct located by the bile which flowed from it. No search was made for the distal end of the duct. A rubber tube 5 centimeters long (section of catheter, No. 12, French), was passed up the duct for about 2.5 centimeters and secured there with chromic catgut. Two stitches of chromic catgut were passed partly through the posterior wall of the duct but mostly through surrounding firm tissues, about 1 centimeter above the point of emergence of the tube, and below through the outer coats of the duodenum. These stitches were tied and a stab wound was made in the duodenum in front of them and the free half of the tube tucked into it. Additional sutures were passed, corresponding to the posterior ones, about the remaining circumference. None of these was tied until all had been placed. The duodenum was thus drawn up about the duct. A soft rubber drainage tube was left close to but not in contact with the anastomosis. The long operation was well borne.

Postoperative course. On the third day following the operation there was a brown stool and each day thereafter during convalescence the stools showed abundant bile. On the fourth day there was profuse discharge of bile through the drainage tract and the temperature, which had been high, became normal. This copious flow continued for several days, then lessened rather suddenly and stopped entirely by the tenth day. The patient left the hospital at the end of two weeks. Her jaundice had disappeared and the sinus had nearly closed. During two months following the operation the patient appeared to be in excellent health and had gained 17 pounds. At the end of this period, however, a sudden chill, epigastric distress and slight jaundice ensued and the stools were colorless on four successive days. During two subsequent attacks at intervals of four and five weeks bile persisted in the stools. The tube has not been recovered.[1 and 2]

In the case reported above, the writer made no attempt to suture the duct mucosa to the duodenal mucosa as the duct was friable and its circumference small. The

[1] Walton describes two classes of obstruction to the passage of bile. In one the gall bladder is either absent or too small to be available for anastomosis and there is an impassable obstruction with dilatation of the duct above it, but no biliary fistula. In the other group, in addition to the absence of the gall bladder, there is a biliary fistula and there is also obstruction without dilatation of the duct. In the first group anastomosis between the enlarged duct and the intestine is relatively easy, but in the latter it is difficult or impossible.

[2] Obstructive attacks have recurred at intervals of ten to twenty-five days, until the present time (August 3, 1918). The ultimate result, therefore, is still in doubt.

duodenum was brought up about the duct and the tube within in an endeavor to form a papilla. Packard (11) reported a case, in 1908, in which benign ulceration of the ampulla of Vater had produced stenosis of the common duct. Packard severed the duct as low as possible and implanted its proximal end into the duodenum through a stab wound, folding the duodenal wall over it. Packard is probably entitled to priority in recognizing the importance of the latter procedure. Harrington (12) reports a case similar to that of Packard.

The technique employed by the writer somewhat resembles that of Mann (13), although Mann deliberately left an interval between the duct and duodenum for drainage. The writer believes that the suture line in his case should have been protected by omentum as advocated by Mayo. Fortunately, however, the leakage seems not to have endangered the result. Phemister states that early leakage of bile is not often harmful since the bile is usually sterile or nearly so. Nevertheless, one case terminated fatally as the result of an infected subphrenic accumulation of bile which had leaked out alongside a drainage tube in the common duct.

Direct anastomosis of the hepatic or common duct to the duodenum about a rubber tube is the operation of choice in the majority of cases, according to Mayo. Therefore, a description of this procedure is quoted, herein, verbatim. When approximation of the duct and duodenum is impossible or excessive tension would be produced thereby, some other expedient must be employed. Jackson (14), overcame the difficulty in his case by making a union of the duct with the jejunum, by the method just mentioned. Jackson's patient recovered without leakage of bile from the anastomosis, although the suture line was not wrapped with omentum.

Walton reports a case in which he bridged the gap between the duodenum and the upper end of an obliterated common duct by means of a flap from the duodenal wall. Walton describes his ingenious operation as follows: "A flap was cut out of the duodenum and turned downward. A tube was inserted into the end of the common duct and sutured in place with twenty-day chromic catgut. The opening in the duodenum was sutured in its upper part, leaving only an opening sufficent to admit the tube. The tube was inserted into this opening, the duodenum being drawn as close as possible to the cut end of the duct with a catgut suture. The flap of duodenal tissue was now sutured around the rubber tube so as to make a new bile duct, catgut sutures being used." The tube was passed from the rectum on the eleventh day following the operation. Four and one half months later the patient appeared to be in perfect health. Ginsburg (15) suggests a modification of Walton's technique, whereby the flap is fashioned with its base above. The flap is turned upward behind the tube, rather than down in front of it, bringing the suture line anterior, instead of posterior to the tube.

Sullivan, in 1909 (16), made a preliminary report, and in 1912 wrote a supplementary paper (17) describing his method of experimental bile-duct reconstruction in the dog. Sullivan inserts a rubber tube into the stump of the hepatic duct and secures it with unabsorbable sutures. The other end of the tube is then pushed down into the duodenum through the stump of the common duct if possible, or if this is not possible, the tube should project through a small incision in the duodenum about one-half inch into its lumen. The duodenal walls are sutured over, so that before the tube penetrates into the intestine, it runs in a canal composed of overlapped duodenum. The great omentum is then drawn up so as to cover the tube. The lumen of the tube should be not less than one-quarter of an inch.

Sullivan states that in dogs the passage thus formed is permanent without tendency to contraction. Microscopic examination of removed segments convinced Sullivan that the mucous membranes of the duodenum and hepatic duct grow toward each other to line the sinus between them. Mann, also, believes that such a tract will become mucus-lined. Sullivan would expect some contraction in inflamed tissues, but not sufficient to impede biliary discharge, provided the canal were large enough originally. Mayo, on the other

hand, states that in a sinus of this character eventual contraction is inevitable.

Phemister reports a case of hæmorrhage from the cystic artery during cholecystectomy due to an anomalous course of the artery. The clamp which secured the cystic duct failed to include the artery. The forceps which controlled the hæmorrhage grasped the hepatic duct with the artery and a knuckle of the duct was ligated. The usual symptoms indicative of obstruction to bile passage ensued. Three months later the precise condition was discovered at operation, and the duct drained with a rubber tube. All the bile escaped through the fistula. Ten months after the second operation a third operation disclosed a necrotic and stenosed section of the duct. This portion was resected, a "T" tube introduced, and the one-half inch gap bridged with omentum. (Modified Sullivan operation.) The tube was left in position for 84 days. In a personal communication (18) to the writer, September 14, 1917, Phemister says: "About three months after removal of the tube the patient began having attacks characterized by epigastric pain, chills, fever and jaundice which recurred irregularly every ten to thirty days. Between attacks she felt well at first but lately jaundice has been more persistent and has been continuous for the past six weeks. I think another operation will be necessary in order to attempt to remedy the condition permanently."

Brewer (19) reports a case in which the hepatic duct and duodenum were united by means of a rubber tube wrapped with omentum after the method of Sullivan. No bile leakage occurred but there were evidences of incomplete bile passage at intervals during convalescence. The rubber tube has not been found in the stools. Brewer believes that the reconstructed duct, although still functionating two months after the operation, is narrowed and likely to close. In a second case Brewer (20) employed the Sullivan technique with most satisfactory immediate result. Later, however, it became evident that the newly formed duct was not functionating and intense cholæmia necessitated a second operation. The stump of the hepatic duct was found buried in cicatricial tissue.

In a personal communication (21) to the writer dated October 4, 1917, Sullivan writes: "My personal experience with reconstruction of the bile duct by my method has been limited to one case, a railroad engineer of about sixty years of age, operated on March 31, 1913, for stenosis of the common duct following its perforation by stones and a gangrenous process. This man since has enjoyed very excellent health and is now actively engaged in his occupation.

"The question as to how great a distance the proliferating mucosa will bridge the interval between divided duct end and the duodenum is still unsettled. I am certain that it will bridge one-half inch within three months. It seems essential to most men for the success of the method that the entire newly formed tract be mucosa lined. This, of course, is the ideal situation, as it is believed this will prevent stenosis as the operation is analyzed by the accepted standards of surgical hypotheses. On the other hand, I offer for your consideration the curious stubbornness of so-called persistent biliary fistulæ which are not mucosa lined. In other words, I know that biliary pressure is a very important factor in the prevention of stenosis in my operation and every effort should be directed to securing a firm walled tube in order that this pressure may be exerted while the mucosa is lining its interior."

Sullivan emphasizes the necessity of carrying out his technique essentially as he describes it, and reiterates his belief that "time and clinical experience will decide" the value of his method. The Sullivan procedure is discussed at length because, should the method prove efficient, its admirable simplicity commends it.

Ginsburg and Speese report a case in which, during cholecystectomy, the wall of the common duct was included in the forceps which secured the cystic duct and both ducts were divided. The distal end of the common duct was tied off with the cystic artery. Postoperative examination of the removed specimen disclosed the accident. A biliary fistula developed and the stools became acholic.

At the second operation nine days later the ends of the divided duct were located

but could not be approximated. A "T" tube was, therefore, introduced and wrapped about with a section of the posterior rectus sheath fascia. One week after operation, bile which had been present, disappeared from the stools. At a third operation, about two months later, it was learned that the distal end of the "T" tube had broken off and was impinging on the duodenal wall. The "T" tube was removed, a simple straight tube introduced, and a fascial repair made about it. (Ginsburg is of the opinion that the employment of a "T" tube renders repair more difficult and the withdrawal of the tube subjects the newly formed duct to unnecessary and perhaps dangerous trauma. In this opinion Sullivan concurs.)

A fourth operation was undertaken for the relief of the upper abdominal distress and many adhesions were freed. The rubber tube was still in place nearly three months after its introduction. An attempt to remove it through an incision in the duodenum was unsuccessful. Bile leakage developed two days after operation and the stools became clay colored. The leakage soon ceased and all the bile was again delivered into the duodenum.

In regard to the use of autogenous tissue grafts to bridge a gap on the duct Walton says: "Neither the tissues of veins, of fascia, or even of the appendix, may be able to withstand the action of the bile. Such an operation involves the use of a somewhat difficult technique, and the suturing of the grafts has to be so adequately carried out that little or no leakage will take place from the line of suture." Phemister states that Lewis and Davis (22) repaired defects in the common duct of dogs with free transplants but a tendency to stenosis followed.

Mayo and Phemister are agreed that end-to-end suture of a duct without the use of a tube is an extremely difficult procedure. It is evident, therefore, that some one of the tube methods herein described would be preferable. When there is an impassable mechanical barrier, either in the head of the pancreas or at the ampulla of Vater, Ginsburg believes that cholecystenterostomy is the operation of choice rather than any procedure involving the ducts. Whenever feasible during operation upon the bile passages, McArthur (23) advises the installation of normal salt solution into the duodenum, thereby decreasing postoperative vomiting and otherwise assisting convalescence.

In the majority of reported cases in which a tube has been used in duct reconstruction the tube has apparently been retained. Ginsburg states that in his case the tube had not been passed four months after the operation. Mayo says, however, that after absorption of the catgut holding suture the tube readily passes into the bowel. Sullivan believes that even when the tube is secured with non-absorbable sutures it will eventually become loosened. In one of Brewer's cases the X-ray failed to locate the tube although it was supposedly still in position. It is, therefore, safe to assume that the tube does loosen and does pass out and that the patient either forgets to look for it or fails to find it in the stools.

It is of interest to note, also, that many of the reported cases are characterized by a more or less stormy convalescence with febrile reaction, leakage of bile, acholous stools, jaundice, abdominal distress, or other disturbing symptoms which may or may not be harbingers of failure.

The following cases are cited on account of historical interest and because the pathology is unusual: Fullerton (24) undertook operation for the relief of symptoms indicative of complete obstruction to bile passage. The common duct was enormously dilated as a result of occlusion by the hard, nodular head of the pancreas (chronic pancreatitis). The common duct was anastomosed to the duodenum by means of a Murphy button. Recovery followed.

Swain's (25) patient was a girl of seventeen who presented symptoms of bile-duct obstruction and a large, right-sided abdominal tumor reaching to the pelvic brim below and three inches beyond the umbilicus to the left. Six pints and one ounce of bile were withdrawn through an aspirating needle. The tumor refilled, and laparotomy disclosed an apparent cystic gall-bladder with extensive adhesions to the intestines. Further search, however, revealed a normal gall-bladder. An anasto-

mosis was effected between the cyst and the jejunum by means of a Murphy button. Swain surmised that he was dealing with a huge common duct but was not certain. Recovery was complete. The button was not passed.

Concerning the use of the Murphy button, Bevan (26) reminds us that this ingenious device belongs to the developmental stage of surgery. It has demonstrated the possibility of safe gastro-intestinal union which is now better done with the needle and thread alone. Occasionally, however, the button is indicated for a rapid anastomosis and may then prove life saving.

CONCLUSIONS

1. Injury to the hepatic and common bile ducts is sometimes inevitable during cholecystectomy. Such operative trauma may be decreased, however, by a more general recognition of the necessity for careful isolation and division of the cystic duct and artery.

2. Reconstruction and repair of the bile ducts are facilitated by the use of a rubber tube.

3. Leakage of bile does not necessarily jeopardize the result. Nevertheless, the suture line should be protected by omentum.

4. No hard and fast rules of surgical procedure can be laid down. Modifications are necessary to meet varying conditions.

NOTE.— Since this paper was written an article by Eliot entitled, "The Repair and Reconstruction of the Hepatic and Common Bile Ducts," has appeared in SURGERY, GYNECOLOGY AND OBSTETRICS for January, 1918. A study of the reported cases abstracted in Eliot's comprehensive paper reveals few records of end-results.

It is sometimes extremely difficult, the writer believes, to determine whether or not a cure may be claimed in view of the fact that obstructive symptoms, at any time subsequent to operation, may be due to cholangitis or a stone rather than to stenosis.

In the event of postoperative obstructive attacks recurring regularly or with increasing frequency, one would hesitate, of course, in reporting success. It is problematical how long a symptomless period should elapse before considering the patient cured.

REFERENCES

1. MAYO, W. J. Restoration of the bile passage after serious injury to the common or hepatic ducts. Surg., Gynec. & Obst., 1916, xxii, 1.
2. JACOBSON. Quoted by Mayo.
3. PHEMISTER, D. B. Reconstruction of the hepatic duct. The Surgical Clinics of Chicago, 1917, June.
4. KEHR. Quoted by Phemister.
5. JUDD, E. S. The technic of cholecystectomy. Ann. Surg., Phila., 1915, lxi, 306.
6. DEAVER, J. B. Operation for removing the gall-bladder. Ann. Surg., Phila., 1916, April.
7. GUTHRIE, D. Indications for cholecystectomy. J. Am. M. Ass., 1916, August 26.
8. SEELIG, M. J. Cholecystectomy. Surg., Gynec. & Obst., 1917, xxv, 45.
9. WALTON, A. J. Reconstruction of the common bile duct. Surg., Gynec. & Obst., 1915, xxi, 269.
10. MAYO. Quoted by Mayo.
11. PACKARD, H. Permanent stenosis of the ductus communis from inflammatory infiltration or cicatricial contraction of a duodenal ulcer. Boston M. & S. J., 1908, July 23.
12. HARRINGTON, F. B. Reimplantation of the common bile duct into the duodenum for stricture at the ampulla due to duodenal ulcer. Boston M. & S. J., 1909, clx, 203.
13. MANN, A. T. A rubber tube in the reconstruction of an obliterated bile duct. Surg., Gynec. & Obst., 1914, xviii, 326.
14. JACKSON, R. H. Anterior choledojejunostomy. Surg., Gynec. & Obst., 1914, xix, 232.
15. GINSBURG, N., and SPEESE, J. Autogenous fascial reconstruction of the bile duct. Ann. Surg., Phila., 1917, January.
16. SULLIVAN, A. G. Reconstruction of the bile ducts. J. Am. M. Ass., 1909, liii, 774.
17. Ibid. 1912, lviii, 2026.
18. PHEMISTER, D. B. Personal communication.
19. BREWER, G. E. Hepaticoduodenal anastomosis. Ann. Surg., Phila., 1910, June, 830.
20. Idem. Observations upon the surgery of the biliary passages. Surg., Gynec. & Obst., 1912, May.
21. SULLIVAN, A. G. Personal communication.
22. DAVIS, C. B., and LEWIS, D. Quoted by Phemister.
23. MCARTHUR, L. L. Further advances in the therapeutic use of the bile tracts. N. Y. M. J., 1912, January 27.
24. FULLERTON, A. Anastomosis between the common bile duct and the duodenum for obstructive jaundice. Brit. M. J., 1907, October 26.
25. SWAIN, W. P. A case of cholecystenterostomy with the use of Murphy's button. Lancet, Lond., 1895, i, 743.
26. BEVAN, A. D. Removal of Murphy button from stomach two and one half years after gastro-enterostomy for duodenal ulcer. The Surgical Clinics of Chicago, 1917, June.

CONGENITAL HERNIA OF THE DIAPHRAGM[1]

By WILLIAM A. DOWNES, M.D., F.A.C.S., New York

DIAPHRAGMATIC hernia, congenital and acquired, occurs much more frequently than was formerly supposed. The diagnosis of this condition can be made with little doubt by means of the X-ray. In the last few years many cases correctly diagnosed and successfully operated upon have been recorded in the literature, whereas according to Scudder (1) up to 1912, there were only six recorded instances in which the diagnosis of diaphragmatic hernia had been made previous to operation. This author states that nearly all cases prior to that date came to operation with the diagnosis of intestinal obstruction which accounted for the high mortality.

The acquired or traumatic cases have been recognized more frequently than the congenital on account of the history, and sudden onset of symptoms. In many of the congenital cases the condition is discovered accidentally in the routine examination of patients that come to the surgeon for the relief of symptoms suggestive of ulcer of the stomach, pyloric stenosis, intestinal obstruction, etc. Still others give no symptoms of the abnormality and die of intercurrent disease, the malformation being discovered at autopsy.

Congenital diaphragmatic hernias are classified as true or false, depending upon the presence or absence of a sac. The great majority of cases come under the latter group, the hernial contents passing directly through the diaphragm either through a dilated normal opening or through an abnormal opening, and lie free in the pleural cavity. This variety of hernia is much more common on the left than the right side, due in part, no doubt, to the position of the liver. The hernial orifice is usually located at the junction of the costal and lumbar portions of the diaphragm, or at

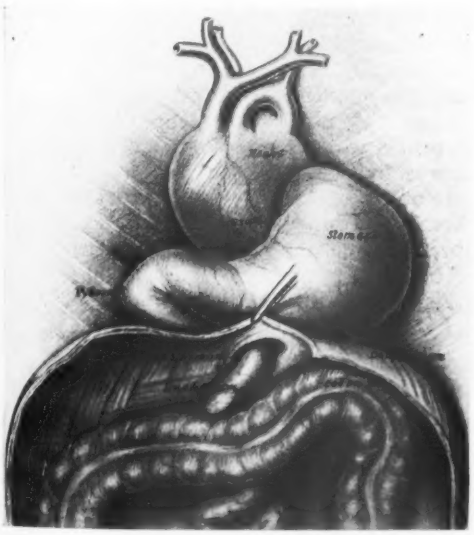


Fig. 1. Congenital hernia of the diaphragm.

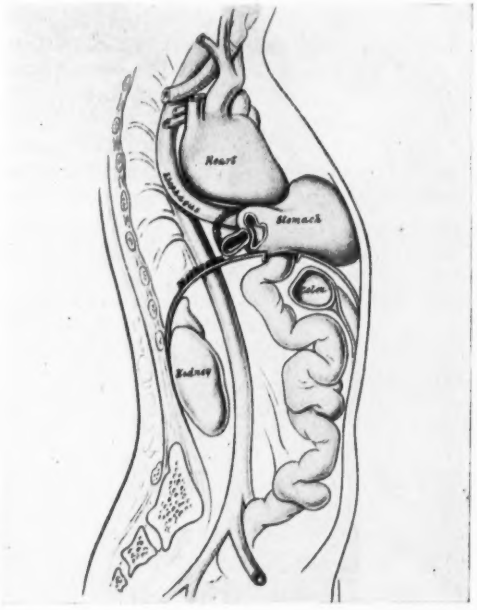


Fig. 2. Diagramatic sagittal section of congenital hernia of the diaphragm.

[1] Read before the American Surgical Association, Cincinnati, June, 1918.

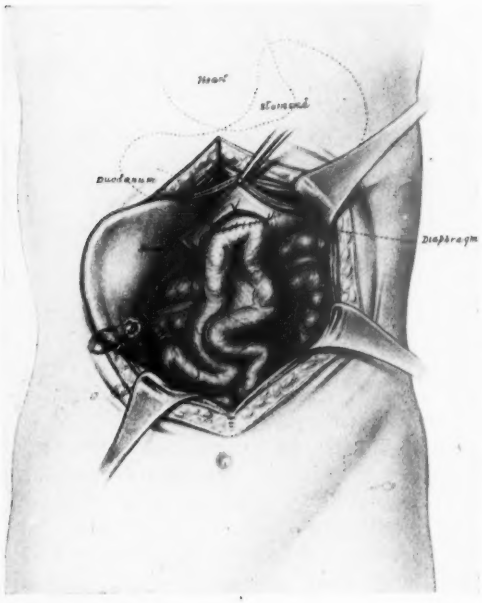


Fig. 3. Anterior gastro-enterostomy through dilated œsophageal opening in congenital hernia of the diaphragm.

the junction of the costal and sternal portions as these are the weakest parts. Hernial protusion at the normal openings in the diaphragm is of rare occurrence.

In a series of 34 specimens of this type of hernia reported by Keith (2), only one was through a normal opening, and that the œsophageal. As the majority of infants born with diaphragmatic hernia die within a few hours after birth, very little opportunity has been afforded for a systematic study of the symptoms; a few cases, however, have been followed over a period of months or years. In those dying shortly after birth, there is either complete absence of one-half of the diaphragm, or a large hernial opening which permits the greater part of the abdominal contents to enter the thoracic cavity. These infants suffer from dyspnœa, become cyanotic, and usually die in convulsions. The symptoms of the cases surviving the period of infancy vary according to the interference with the lung and heart by the viscera in the thorax, and according to the amount of constriction of the stomach or intestines at the hernial orifice as shown by attacks of dyspnœa with cyanosis, periodic attacks of pain, nausea, vomiting and loss of weight. There may be periods of weeks or months in which these patients are free from symptoms during which time they gain in weight and strength.

The question arises whether some of these cases, in which the symptoms come on some months after birth, are really congenital or whether they are merely potentially so in that there is an unusually large normal opening through the diaphragm, or an undue weakness, and that the negative pressure of the thorax plus some possible trauma may not be the exciting cause. The physical signs will vary according to the number of abdominal organs in the thorax, the position of the patient, and according to the state of the hollow viscera — whether filled with fluid or air. Several cases have been recorded in which the full stomach situated above the diaphragm has been mistaken for a pyopneumothorax and aspirated, with a fatal result. In view of this danger all patients with obscure or unusual physical signs in the chest, especially with a long history, should be subjected to X-ray examination before an exploring needle is introduced. Once the diagnosis of hernia of the diaphragm is established, the question of operation arises. In the cases discovered accidentally, which give no symptoms, it is an open question whether to advise operation or not. A number of instances have been recorded where a slight trauma has been followed by acute symptoms necessitating exploratory operation, and a diaphragmatic hernia of undoubted congenital origin has been found, thus indicating that such a condition is a constant source of danger. For this reason, these patients should be advised of the dangers, and offered the benefit of an operation. Should acute symptoms arise in a known case of diaphragmatic hernia, immediate operation is indicated.

There is a difference of opinion among surgeons as to whether it is best to approach diaphragmatic hernia through the thorax or abdomen. It is claimed by some that the rent in the diaphragm can best be closed through the chest. While this may be true, especially for traumatic cases, this advantage

Fig. 4. Roentgenogram of N. C., 6 hours after second meal. Residue still present after 24 hours.

Fig. 5. Roentgenogram taken four months after operation, 20 minutes after meal.

is more than offset by the knowledge gained from an exploration of the abdominal cavity, and the ability to apply the correct operative procedure without delay or the added danger of a prolonged operation. Not infrequently the thoracic incision has had to be supplemented by an abdominal incision in order to restore the viscera to their proper positions, or for the purpose of closing wounds of the stomach or intestine. Furthermore, in the congenital cases in which the hernia has occurred through a dilated normal opening, such as the œsophageal opening, it would be impossible to correct the condition by approach from above.

The ideal result to be desired in a case of congenital diaphragmatic hernia is the restoration of the hernial contents to the abdominal cavity with closure of the opening in the diaphragm. This will be impossible in the case in which there is complete absence of one-half of the diaphragm, and in those in which the organs are too fixed to permit of mobilization. In the majority of recorded cases, however, it has been possible to restore the organ or organs to the abdominal cavity, and close the opening in the diaphragm. In a few instances where the opening was too large to close satisfactorily, the stomach or omentum had been used to complete the closure.

A case of hernia of the diaphragm in which it was impossible or at least unwise to attempt reduction recently came under my care.

The entire stomach and about three inches of the duodenum had passed through a dilated œsophageal opening (Fig. 1.) Whether the condition had

Fig. 6. Congenital hernia of the diaphragm, six weeks after operation.

existed from birth or whether it dated from the onset of the symptoms, at 20 months of age, it is impossible to say. The stomach ran transversely and rested immediately upon the upper surface of the diaphragm, extending slightly more to the left than the right side of the chest. There was no hernial sac. The œsophageal opening was slightly oval, being about 2 inches in its transverse diameter. Upon opening the abdomen it was noted that the liver lay well to the left, and it was found necessary to divide the round ligament in order to expose the area usually occupied by the stomach. The duodenum could be seen passing up through the œsophageal opening, but no part of the stomach was visible. The finger introduced into the thorax could just reach the pyloric end of the stomach posteriorly, and to the right. Gentle traction made on the duodenum failed to dislodge this portion of the stomach. As the child's condition was extremely poor it did not seem wise to enlarge the hernial orifice for the purpose of separating adhesions which would have been necessary before further attempt at reduction could be made. Realizing the great danger of further effort to restore the stomach to its normal position, and the necessity for overcoming the obstruction at the pylorus, it was decided to perform a gastro-enterostomy. The greater curvature of the stomach was grasped with sponge clamps, and a sufficient portion of the stomach wall, for the purpose, was readily drawn into the abdominal cavity. An anterior long loop gastro-enterostomy was performed. The gastrocolic omentum was split, and the opening placed low down on the posterior wall of the stomach. In order to avoid the danger of the intestine entering the thorax the stomach was anchored to the margin of the œsophageal opening by three interrupted silk sutures just proximal to the anastomosis (Fig. 3). Convalescence was straightforward. Lavage was given daily for one week. There was no vomiting after the fourth day. Emphysema of the left side of the thorax, extending from the costal arch to the clavicle, appeared on the fourth day, lasted four or five days, and then disappeared, giving rise to no symptoms. The patient was discharged from the hospital at the end of five weeks, free from symptoms. At the present time, five months after operation, he has gained 10 pounds in weight, eats any and all sorts of food without vomiting or distress.

As has already been stated many cases of diaphragmatic hernia have been discovered accidentally at an advanced age, demonstrating that such a condition is compatible with health and life. Therefore, since the symptoms due to obstruction have been entirely relieved in this boy, by the gastro-enterostomy, it seems fair to assume that he will continue to gain and develop in a normal manner even though his stomach remains in the thoracic cavity. The history of the case is as follows:

N. C., aged 7, admitted to St. Luke's Hospital, December 28, 1917.

Chief complaint. Vomiting and failure to gain weight. History dates back five and one-half years about which time he began to vomit immediately after taking food. The vomiting came on in periodic attacks, lasting from two to three months, with free intervals of about the same length of time. This continued until three and one-half years ago when vomiting ceased entirely for a period of nine months. During the preceding two years, growth had been greatly retarded, but during the nine months in which food was retained, gain in weight and strength was rapid. About one and one-half years ago vomiting recurred, and has continued to the present time. The periods of remission instead of being from two to three months have been for only a few days at most. Occasionally he would vomit after one meal, but usually after every meal. He felt discomfort after eating, and recently if he could not vomit would force himself to do so by putting his finger

down his throat. The vomitus consisted of food recently taken into the stomach, and varied in amount. The child was breast fed until two years of age. He had a severe convulsive seizure when one and one-half years old, and at two years of age was dropped one flight of stairs. The vomiting attacks began at some time between these two incidents.

Physical examination. He is a poorly nourished, undersized male child. The chest is of peculiar shape; very long and narrow. Expansion is poor. The percussion note is good anteriorly although the liver dullness is very high; cardiohepatic angle is obliterated. Posteriorly the liver dullness reaches to a four inch space. The apex beat of the heart is in a four inch space just inside the left nipple line. The heart appears to be enlarged to the right. Stomach tympany obscures dullness on the left. The abdominal examination was negative. Weight 27½ pounds. Tuberculin test negative. Provisional diagnosis on admission: cyclic vomiting.

X-ray examination (Le Wald) demonstrated the stomach to be above the diaphragm. As part of the bismuth meal was vomited, the emptying time could not be accurately determined, but was shown to be very slow. A bismuth enema demonstrated the colon to be of normal size and location.

Diagnosis. Diaphragmatic hernia (stomach).

Operation, January 4, 1918. Anterior gastro-enterostomy. Intratracheal anæsthesia (Luke). A median abdominal incision was made extending from the ensiform to the umbilicus. The liver was situated nearer the median line than normal. It was necessary to divide the round ligament in order to expose the area usually occupied by the stomach. The duodenum was seen passing through the dilated œsophageal opening, but no part of the stomach was to be seen. A finger inserted through the dilated opening located the stomach entirely above, and resting upon the diaphragm. Traction upon the duodenum failed to dislodge the pyloric end of the stomach. In view of the very poor condition of the child, it was thought best not to attempt to restore the stomach to its normal position, but to perform an anterior gastro-enterostomy through the dilated œsophageal opening. This was easily accomplished by drawing the greater curvature of the stomach partly into the abdomen. The jejunum was brought forward over the transverse colon, and the anastomosis made about sixteen inches from the duodeno-jejunal junction. The stomach wall was anchored to the margin of the œsophageal opening. Convalescence was uninterrupted. The patient was discharged symptomatically cured, February 16, 1918.

REFERENCES

1. Scudder, C. L. Surg., Gynec. & Obst., 1912, xv, 261.
2. Keith, A. Brit. M. J., 1912, ii, 1297.

INTRATHORACIC GOITER[1]

By O. F. LAMSON, M.D., F.A.C.S., Seattle, Washington

NO lesion of the thyroid gland seems to sail so long under false colors as intrathoracic goiter, which as its name indicates is lodged within the thorax and does not manifest itself externally through enlargement of the neck as other types of goiter do. Therefore it often escapes detection. It has been stated that not more than 50 per cent of intrathoracic goiters are definitely diagnosed before operation.

Respiratory symptoms being the most annoying, such patients are often treated for various diseases of the respiratory system; also for aneurism or for malignant tumors of the thymus, and for thymus hypertrophy, etc. For instance, a patient with a true intrathoracic goiter, who came under my observation, was treated for asthma at various health resorts. He even had undergone an operation on the nasal passages to relieve him of the asthmatic symptoms which at times had been most distressing. When the presence of a goiter was suggested to him, he was very much surprised, as at no time had he noticed any external signs of a goiter. However, during the act of coughing a rather marked bulging in the supraclavicular region could be demonstrated. Further examination revealed circumscribed dullness substernally in the left upper chest extending down to fourth rib.

Roentgenograms of this case showed a well-defined tumor in the thorax displacing the trachea to the right, thus substantiating the diagnosis of intrathoracic goiter. Fortunately roentgenograms of these goiters usually give a rather characteristic picture and aid materially in the correct diagnosis, which is not always an easy matter.

[1] Read before the King County Medical Association, January 21, 1918.

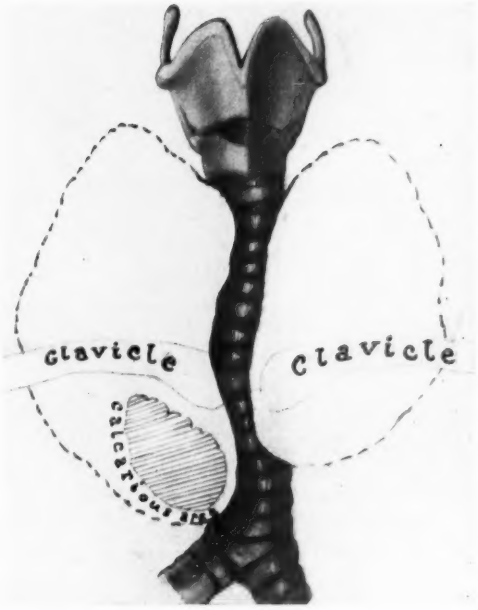


Fig. 1. Intrathoracic goiter. Opposing lobes produce a vice-like grip on the trachea. Calcareous area in the lower right lobe.

The gross pathology of intrathoracic goiter does not differ from that of other forms of goiter. It may be atoxic (simple goiter) with which the individual exhibits no evidences of any disturbances of the normal metabolism which could be attributed to the goiter. Again substernal goiters may be associated with notable hyperplasia and be highly toxic in character, causing the usual constitutional disturbances which go with thyroid intoxication.

The tissues of an intrathoracic goiter may undergo calcareous, or, through irritation, even malignant degeneration.

The symptomatology of intrathoracic goiter is rather characteristic. All symptoms are mostly due to pressure on the neighboring organs, produced by the enlarged gland. When portions of the gland extend between the trachea and the œsophagus, the trachea may be exposed to direct pressure from all sides. Pressure on the œsophagus, on the blood vessels at this region, on the vagus, and the laryngeal nerves may give rise to various and often most annoying symptoms such as respiratory embarrassment, cyanosis, cardiovascular disturbances, dysphagia, and dysphonia.

Primarily patients complain of more or less acute respiratory embarrassment. They speak of being threatened with suffocation, undoubtedly due to the narrowing of the respiratory channel. This will not always depend on the actual bulk and size of the gland but more on its shape and denseness. Calcareous areas, malignant tumors in the gland will aggravate respiratory symptoms. Pressure on the trachea may give rise to an annoying cough, laryngeal in character.

Cyanosis may accompany dyspnœa. Pressure on the carotid and the jugular veins and on the vagus may aggravate this symptom. As

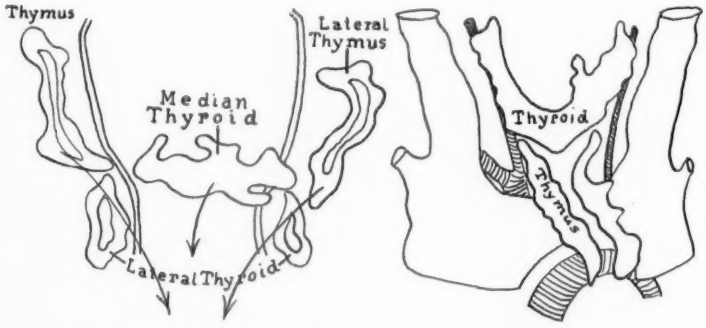


Fig. 2. Reconstructions of developing thyroid, thymus, and parathyroid bodies in embryos of 14 millimeter and 26 millimeter. (From Piersol.)

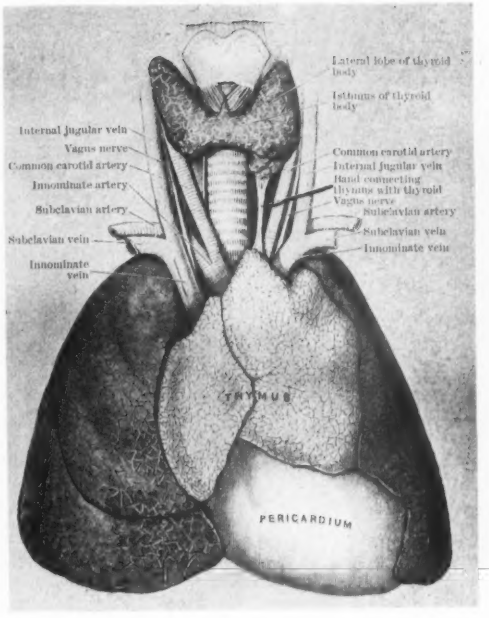


Fig. 3. Thymus gland in full-time fœtus hardened by formalin injection. (From Cunningham.)

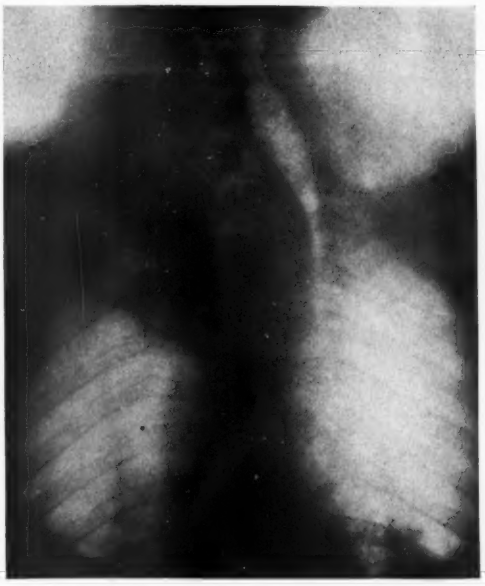


Fig. 4. Roentgenogram showing displacement and narrowing of trachea.

the thyroid gland is one of the most vascular structures in the body, any undue pressure upon this organ may cause dilatation of the blood-vessels in contact, so characteristic of intrathoracic goiter. Such vascular disturbance, besides being the cause of cyanosis, may give rise to headaches and to sensations of fullness.

Often marked cardiovascular disturbance we find associated even with simple intrathoracic goiter, due to pressure on the blood-vessels and nerves of this region, sometimes accelerating the action of the heart and producing the so-called "mechanical goiter heart."

Dysphagia may occur in connection with intrathoracic goiter as the result of pressure on the upper end of the gullet or on the lower portion of the pharynx. This phenomenon is more common with left sided goiters, perhaps owing to slight curvature of the œsophagus toward the left.

Dysphonia is generally produced through pressure on the recurrent laryngeal nerves, as they lie against the inner surface of the gland, the left one being in actual contact with the thyroid gland. Finally we find that the patient's general metabolism is somewhat disturbed even though the goiter may be atoxic in character.

Generally intrathoracic goiter involves but one lobe of the thyroid although it may extend to the other side of the trachea on its anterior or posterior surface, suggesting a bilateral goiter within the chest.

A bilateral intrathoracic goiter just recently came under my observation which seems to be of sufficient importance to warrant a brief report.

The patient gave a typical history of intrathoracic goiter. During operation it was found that the whole gland was firmly bound to the trachea and a good sized cystic tumor occupied the end of both lobes pulling down the whole gland into the chest and naturally exerting considerable pressure in the trachea to the opposite side (Fig. 1). In this case the opposing lobes produced a vice-like grip on the trachea without displacing it. Especially marked was this condition during a spasm of coughing when the movements of the lungs forced the two opposing lobes in closer opposition, making respiration most

Fig. 5. Roentgenograms showing displacement and slight narrowing of trachea.

Fig. 6. Roentgenogram showing displacement of trachea

difficult, although the trachea maintained its normal position. During coughing spells the patient was repeatedly threatened with strangulation, losing consciousness several times during these attacks. Another interesting incident was the frequent breaking of the patient's collar bands during these coughing spells, due to the excursion of the gland during this act. For several months previous to operation the patient broke on an average of three or four collar bands a week. On account of calcareous degeneration of a considerable area in the lower right lobe, his symptoms of dyspnœa were most acute.

A rather peculiar feature of pendulous type of intrathoracic goiter is that it is migratory in character. When in repose it may be found above the sternum but during a violent respiratory act it may slip below into the mediastinum. Sometimes it happens that the glands become lodged and remain in the thorax. Generally it returns to its former position. I saw a patient who for some time had noticed a pendulous, movable, moderate sized goiter in the neck, which one day during a coughing spell, fell into the chest and remained there until operation—a period of a year and a half. Following that incident she had frequent violent coughing spells accompanied with acute respiratory embarrassments. Her history made me suspect a pendulous intrathoracic goiter.

A few anatomical observations of this organ may throw some light on this phenomenon. Normally the thyroid is firmly attached to the cricoid cartilage by the upward prolongations of its capsule—its suspensory ligaments—and to the subjacent larynx and trachea by connective tissues, in such a way that normally it follows the trachea in all its movements. Probably in the stated case, a complete attachment of the gland to the larynx and trachea had not taken place. Again it may be possible that the embryonic-like vesicle, with which the fœtal gland is attached to the thymus, still persisted drawing it downward or at least facilitating its sudden displacement.

Going over the embryology of the thyroid and the thymus glands, such a displacement or congenital dislocation seems probable. From the third and fourth pharyngeal pouches come forth the anlages of both structures, two pairs of hollow tubular bodies. The connecting ducts, gradually atrophy, they are set free and migrate caudalward. The two anlages of the thyroid take a transverse position and join across the mid-line by some connective tissue, the so-called isthmus.

The lumen is lost, solid groups of cells appear and form the primitive thyroid-follicles (Fig. 2).

The thymus anlage appears as a ventral and medial prolongation of the third pair of pouches. When they are set free their lower ends enlarge and migrate, also caudally, but they pass before the thyroid into the thorax, and through elongation and rotation they gradually change their former location and resume a position nearly parallel with the body axis. The upper ends become attentuate and atrophy or may persist as an accessory thymus lobe. The latter may remain in contact with the thyroid (Fig. 3). It is thought to be possible that the thyroid during this act may be pulled downward into the thorax. Thus the thymus may be the cause of the malposition of the thyroid when the latter is found in the thorax. Any disease of the gland in this region may be rightly termed "congenital intrathoracic goiter." Such goiter is prone to escape attention, or if detected by the attending physician it may be taken for a persisting thymus gland or for aneurism or for a malignant tumor.

An intrathoracic goiter may also develop from a separate accessory thyroid which may develop from fragments that became lodged in the thorax; an incident not so uncommon. One of my patients had never noticed any enlargement in the neck, and had no recollection of any structure within the neck becoming dislocated. During operation a goiter lower in the neck and a large cyst hidden behind the sternum was found. The gland proper was located up in the neck at the normal position. This one may be classed as a true congenital intrathoracic goiter; possibly originating from an accessory thyroid gland.

In deferential diagnosis, nothing can be of greater diagnostic assistance than the roentgenogram and fluoroscopic observations which give a very characteristic picture.

1. A benign enlargement of the thyroid gland as a rule follows the movements of the larynx and that of the trachea during deglutition, but a malignant tumor or an inflammatory growth of the thyroid usually becomes anchored to the surrounding tissues. If the latter condition be the case, the roentgenogram will show no separate shadow, but the tumor in the mediastinum will be seen fused with that of the lung. On the other hand an intrathoracic goiter through its mobility and denseness of tissue will cast a separate, sharply defined shadow. As the patient swallows, the entire shadow will rise from 0.5 to 1 centimeter and fall again with the trachea.

2. Engal and Molitsch call attention to the abnormal width of the shadow cast by the organs above the heart and below the thyroid, where the enlarged thyroid extends downward behind the sternum and exerts considerable pressure on the lungs.

3. The trachea may be seen to deviate from the midline. This is especially true with unilateral forms. Owing to the natural position of the œsophagus slightly to the left, such a displacement of the respiratory channel is especially common when the left lobe is the one extending in the thoracic cavity. In bilateral intrathoracic goiter, the trachea will be found in its normal position, because pressure will be exerted on its walls from both sides.

In conclusion it may not be amiss to make a few remarks regarding the operative procedure and the complications that may arise during operation. On account of the severe respiratory symptoms it is preferable to use local anæsthesia whenever possible. The operative field is thoroughly infiltrated with a half of one per cent novocaine with adrenalin. This can be injected very freely. The usual collar incision is made. The capsule of the gland is opened and the goiter carefully dissected out. Blunt dissection is used as much as possible, but sometimes on account of the depth of the gland, it may be practically impossible to reach the lower part of the tumor with the fingers. If this be the case, a tablespoon may be found very convenient and practical to complete the dissection. The intrathoracic goiters which have come under my observation have been of considerable size, but it has never been necessary to divide the sternum or disarticulate the clavicle as has been advised.

Thyroidectomy for intrathoracic goiter has

a number of most serious difficulties, mostly due to the position and character of the goiter, and its influence on the neighboring structure. Profuse hæmorrhage may occur during or after the operation. To guard against such an accident it has been my custom as soon as the goiter is delivered, to pack the cavity with a hot saline pack, leaving it there for a few minutes. This procedure has always effectually checked the hæmorrhage. I have been most fortunate in never having had to deal with postoperative hæmorrhage in such cases. Tracheotomy may be imperative at any time during operation,—as with such goiters where the tracheal walls have been subjected to constant pressure for a long period, it is well to bear in mind the danger of sudden collapse of the trachea, when the tumor is removed.

In spite of many serious phases of the operative procedure in intrathoracic goiter, the results are among the most sensational and gratifying in modern surgery, provided the removal of the goiter takes place before the surrounding structures have suffered beyond repair.

TWO HUNDRED AND TEN FIBROID TUMORS TREATED BY RADIUM[1]

By HOWARD A. KELLY, M.D., F.A.C.S., Baltimore

THE life history of a uterine fibroid tumor has been the object of many careful studies and is well known. These tumors possess three striking clinical characteristics: they can nearly always be labeled benign; they usually give trouble either by compressing the neighboring organs, or by hæmorrhage, which is common; the incidence of malignancy is small, and the presence of carcinomatous or sarcomatous changes can almost always be excluded by a thorough curettage and the microscope.

We find also sometimes complicating diseases of the uterine tubes and the ovaries, or some other incidental abdominal abnormality, such as appendicitis, gall-stones, gastric ulcer, etc. These complications are revealed by a thorough examination and a careful consideration of the history. In cases of persistent pain or disturbance of function in some abdominal organ, a complication can be assumed. We conclude, therefore, that in a vast majority of cases, it is not difficult to determine by a careful preliminary investigation when we are dealing with a fibroid growth of the uterus, pure and simple.

The only effective method of treating fibroid tumors until recently has been the surgical, developed with such care through two generations from the days of Burnam, Kimball, Atlee, Stimson, Baer, Keith, and Price, down to the present, until the operation has become in skilled hands one of the safest of our major procedures. Taking an average of all operations, however, throughout the country, as they are handled by the skilled and the unskilled, the risk to life and health is still considerable even in the simple cases; it is greatly increased in infected sloughing tumors, and somewhat enhanced where the hæmoglobin is below 30 per cent. In both skilled and unskilled hands there is the ever-present dread of cardiac embolism, often occurring about the time the patient is superintending the packing of her grip, happy in the anticipation of the home welcome; truly a tragic ending. With skill or without it, in lesser or in greater degree, hysterectomy is followed in a considerable proportion of cases by a protracted convalescence and untoward sequelæ in the shape of post-operative suppurations, adhesions, hæmatomata, infections of the cervical stump, ventral hernias, and prolapse of the vaginal vault.

Even where there is no complication following the hysterectomy, there still remains the disagreeable and painful hospital experience, while it is rare for the patient to be able to take up her routine burdens of life under several months. This, coupled with

[1] Presented before the American Gynecological Society, Philadelphia, May 16–18, 1918.

the unavoidable indictment that it is after all a mutilating operation, tends to make welcome some better substitute procedure.

With these objections in mind, my position in the past in the matter of the surgical treatment of these tumors has been not to interfere, when the growth was not causing pain or discomfort through pressure, nor reducing the patient through hæmorrhage, but to wait and watch. When the tumors grew rapidly and bled excessively, or where pain and pressure symptoms were pronounced, I have recommended operation.

In this way I have operated upon about two thousand women. If then, I have radically changed my viewpoint, and come before you with another non-surgical method of treatment, you will realize that I must at least be under the conviction that I have discovered a better and a safer course.

I present today a list of all cases, which Curtis F. Burnam and I have treated with radium, with the declaration that it has favorably affected almost every uncomplicated fibroid tumor of whatever size we have had to deal with.

Let me state the contentions of my thesis dogmatically, and declare that we have accomplished by the radium treatment:

1. Control of hæmorrhage and the checking of menstruation.
2. The shrinkage of the tumors.
3. In many instances the disappearance of the tumors.
4. In some cases (even after two years) the return of menstruation, either normal or scanty.

There has been no mortality causally associated with our 210 consecutive radium treated cases; and 21 of these patients could not have been operated on without great danger owing to serious systemic complications. Tuberculosis was present in 2; nephritis in 4; heart disease in 9; profound anæmia in 4; diabetes in 1; bronchiectasis in 1. Some instances of extreme corpulency might be added to this list.

As justifying these claims, I present the following 210 cases of uterine fibroid treated with radium between March 23, 1913, and January 12, 1918.

Of the 210, 146 were 40 years of age and over, and 64 were under 40. Let me note that, contrary to the experience of X-ray therapists, we find it just as easy to treat effectively young women as those who are older.

In addition to this list of 210, there were 45 patients admitted to the hospital during the same period where a surgical operation was elected. A few of the earlier patients, although there were no contra-indications to radiation, demanded operation; or the physician chose operation, owing to the comparative novelty and uncertainty as to final result of the radium treatment. In the remainder there was some complicating condition. The cases excluded from radiation were:

Ovarian cyst	9
Appendicitis	7
Pelvis choked by big tumor, and intra-uterine radiation impossible	6
Severe pain	5
Adhesions	4
Operation preferred	4
Myomectomy to preserve uterus, menstruation, and the possibility of conception in young women	2
Gall-stones	2
Pelvic inflammatory disease	2
Cæsarean section	1
Right inguinal hernia	1
Prolapse	1
Extra-uterine pregnancy suspected	1
Total	45

Today in the light of our greater experience not all of these 45 would be excluded from radiation. It is now always possible, for instance, to treat through the abdomen the large tumors, which choke the pelvis and make an intra-uterine radiation difficult or impossible. Many cases complicated by adhesions and pain are relieved of these symptoms as well as of the tumor and the bleeding. A minor operation, such as the repair of an outlet or even the removal of an appendix, can be carried out in conjunction with the radiation. Then, too, in a young woman it is sometimes possible to radiate away a fibroid and still preserve the possibility of conception.

Where there is doubt about the diagnosis, operation is to be elected as preferable to radiation.

ANALYSIS OF GROUPS

Group 1. Taking up the first group of 146 patients, who were 40 years of age and over, with uterine fibroid tumors, 66 are at the present time cured, in the sense that the tumor has either completely disappeared, or is shrunken to such an insignificant size as to be negligible.

In 48 the tumor has markedly diminished and the symptoms, such as pressure, hæmorrhage or pain, have been relieved. This second division of our group is not static, as with the lapse of time its more recent members are constantly passing over into the first division; it is two-thirds made up of recent cases, occurring within the past two years, where radium has not had time to exert its full effect.

Nine of the patients are symptomatically so well that they refuse re-examination.

One is reported unimproved. A fibroid tumor reaching three-quarters way to the umbilicus was complicated with gall-stones; an operation for both conditions was advised and refused. A single intra-uterine treatment was then given and the patient, never examined again, still complained. As her distress was mainly due to gall-stones, naturally she was not relieved. A second case in this group, which has proved resistant to treatment, had had many X-ray treatments in Munich, between February and May, 1914. She was treated June 6, 1916, with 524 milligrams, intra-uterine, for 2 hours and 40 minutes, and with 2433 milligrams for 7 hours abdominally. In February she was given 9 treatments totalling 27 hours with the following amounts: 996, 1466, 1877, 1491, 831, 1089, 1313, 4466, 1066 milligrams. In May, 1917, there was still some bleeding and no reduction in the size of the tumor.

In three instances operation was done after radiation: one for a complicating ovarian abscess; one because the patient continued to worry in spite of the fact that the tumor was greatly reduced and bleeding had ceased; and one because a sciatica developed — thought to be due to the fibroid, but unrelieved by its removal.

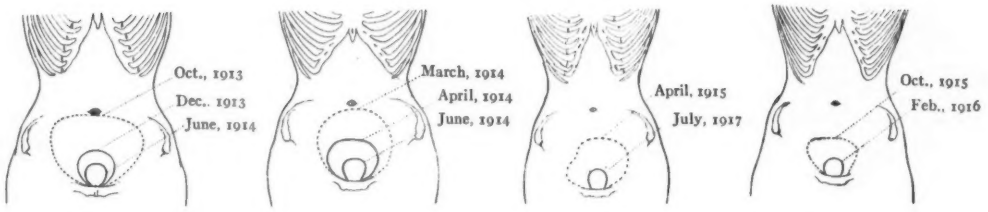
Although the radium treatment of fibroid tumors has never caused the death of a patient, this first group includes two patients dying shortly afterward from other causes; one, a woman of 45, who died of apoplexy at her home about a month after her treatment, and another, an exsanguinated patient who died after inside and outside radiation two days after her arrival at the hospital.

When we add those who did not return for additional necessary treatment (4 cases), those lost sight of (8 cases), and those where treatment is too recent to report results (8 cases), the total of 146 is made up.

In résumé, setting aside sixteen where data are insufficient, and the 2 patients dying from other causes, we have 128 left; in 123 of these radium has made the tumor disappear or diminished it markedly, or robbed it of all clinical significance. In two shrinkage took place but an operation was done in one case because the patient continued to worry and in one case because of sciatica. Two were complicated by gall-stones and ovarian cyst, and one was recalcitrant to treatment. (The ovarian abscess occurred two years after radiation and had apparently no connection with it.)

The most obvious result of radiation is its effect on menstruation. In Group 1, 28 did not menstruate after treatment; 48 menstruated once; 31 menstruated twice or more before amenorrhœa was established. In 2 menstruation previously excessive became normal; in 7 the menopause had arrived before treatment. In 10 bleeding did not cease, and treatment had to be repeated several months later to secure amenorrhœa. In 3 operations were done; in 9 no accurate data as to cessation were obtainable; 8 are too recent to report results.

Menopausal symptoms during amenorrhœa caused by radium treatment are not severe as a rule. In 54 no symptoms were mentioned; in 32 they were moderate, causing no particular inconvenience; in 25 they were distinct and definite. In 7 the menopause was reached before treatment; in 6 the menopause was not induced; and in 3 an operation was performed. These with 11 in which there was no report, and 8 too early to report results, make up the 146.



Case 1. Case 2. Case 3. Case 4.

Group 2. This series includes 64 fibroid tumor patients under 40 years of age treated with radium, and presents slightly different results, as such patients under exactly equal dosage are more likely to have a return of menstruation after a period of amenorrhœa of a year or more.

In 28 out of the 64, the tumor has either disappeared or has practically gone. In 4 of this group menstruation is known to have returned and is either scanty or normal. It may have returned in others and not have been reported, as these patients are well and have not kept up correspondence. About one-half are still too recent for menstruation to have returned.

In 16 instances the tumor has decreased in size. Four of these are menstruating; in two the menstruation has returned and two have not ceased to menstruate.

Menstruation has stopped or has been reduced in four who feel well and refuse an examination; two are not menstruating; menstrual periods in one are scanty, and in one normal.

Operation was done after radiation in six. In one the tumor did not diminish and a calcified fibroid was found. In two, bleeding not being controlled by one treatment, an operation was requested; a submucous myoma was found in each case. In two operation was necessary because of complicating ovarian trouble. In one case an operation was done elsewhere simply because the patient insisted; this was unnecessary as she was on the road to recovery.

To these should be added three from whom we have received no report, two withdrawing from treatment, and five too recent to report results.

If we aggregate and summarize Groups 1 and 2, we have a grand total of 210 cases of uterine fibroid treated between March, 1913, and January, 1918. The average age of all these patients was 43 years, the oldest was, 67 and the youngest 26. Menorrhagia, metrorrhagia, or both were symptoms in 160 cases, while 50 cases did not have bleeding as a symptom.

	Cases
Tumor gone or practically gone	94
Tumor diminished	64
Symptomatically well, no examination	13
Unimproved (1 complicated)	2
Operation after radiation	9
Died other causes	2
Did not complete treatment	6
No report	7
Too early for report	13
Total	210

If we put aside the last four groups (28 cases) in which the data are insufficient, we have left 182. Radium alone was sufficient in all but 11 of these to relieve the patient. In 5 of the 11 there was some other complicating condition, and in 2 operation was elected. In 3 operation proved to have been unnecessary, and one proved utterly resistant to treatment.

A word about the seven withdrawing from treatment. In three of these a reduction of the tumor had been secured and a favorable outcome was to be expected had the treatment been persevered in. In 2 amenorrhœa had been obtained for several months, in 2 the reports are vague and unsatisfactory but menstruation was apparently not stopped.

Where menstruation is not stopped by the treatment, or where menstruation returns before the fibroid is gone, the tumor is likely to continue to grow. If menstruation stops

but returns while the tumor is still present and the tumor starts to increase in size, it is always possible to continue radiation, stop menstruation, and again check the growth. We have never seen a tumor grow during a radium amenorrhœa.

TECHNIQUE

Our technique has been a gradual development. In the beginning we had no fixed notions as to dosage and method, and looking backward I cannot but congratulate myself that we have had no permanent serious sequelæ.

Certain general conclusions as to effectual treatment may be stated, but in actual practice no cut and dried plan is applicable. The treatment of a small differs from that of a large tumor. Where submucous fibroids obstruct the canal and prevent the ready introduction of the radium into the uterine cavity, a different plan must be employed from that used in the ordinary case with a patulous cervix. Where a submucous fibroid is sloughing and others are present, it is advisable first to remove the sloughing growth vaginally, and then to treat the remainder by radium. Where a return of menstruation is desirable, it is important to locate the ovaries and to protect them during the treatment.

It is best to produce an amenorrhœa which shall last until the fibroid is gone. It is not uncommon to see the tumor begin to grow again when menstruation is not stopped. We know from our pathological examinations and our clinical experience that the chief effect of the radium falls directly on the fibroid cells and that the shrinkage of the growth is dependent to a much less degree on the cessation of the ovarian function; nevertheless, amenorrhœa is an excellent guide as to adequate dosage.

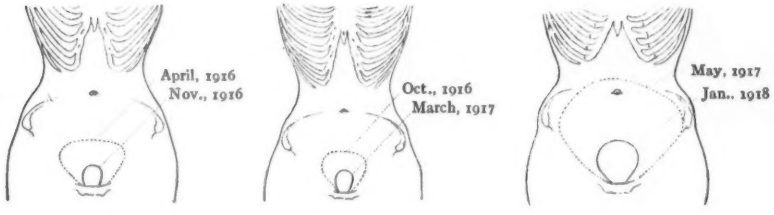
As a rule, a single intra-uterine dose of 1500 millicurie hours is sufficient to produce an amenorrhœa and shrinkage or complete disappearance of the tumor. An equal effect is producible by a radiation with a gram of radium, at a distance of 4 inches from the skin, distributed at various points over the tumor for 24 hours. Either of these methods may be selected, or they may be advantageously combined. The amenorrhœa usually lasts from a few months to two years; in some it is not secured, and in some it is permanent.

It is, as a rule, not advisable to give more than 1500 millicurie hours inside the uterus, for overdosage results in local injuries leading to persistent discharges and an occasional arthritis; there is also a great deal more discomfort from overdosage, for days and sometimes for weeks, following treatment. There is, however, no such limitation on outside dosage. By using a number of portals, the treatment can be made ten times as strong as this average normal dose without any injury to the skin. A deep radium skin burn is a disagreeable complication. It was seen but once in this group and called for excision. An ideal treatment ought not to provoke even a slight erythema.

Again before taking up the details of the treatment, I wish to emphasize the importance of a careful general, as well as local, examination in each individual case. A preliminary curettage should be done, to rule out malignancy and to remove any polypi. Calcified fibroids, which are naturally not responsive to treatment, can be excluded by an X-ray examination, desirable in all cases.

For an inside application of 3 hours with 500 millicuries of emanation, a minute glass bulb is set in the end of a short metal tube which is thick enough to screen off all but the γ-rays. This is then screwed onto the end of an ordinary uterine sound and covered by a rubber cot. Either with or without anæsthesia, the cervix is dilated and the sound introduced to the fundus. This little operation may be done on the patient's bed, and she is then kept in one position by means of knee pillows and sandbags. The intra-uterine applicator remains not longer than half an hour on each spot, and an average of six changes is made by turning once from right to left and then by withdrawing the sound 1 centimeter at a time.

In the external treatments, in order to shorten the time, we use from 4 to 5 grams of radium, and give the entire treatment



Case 5. Case 6. Case 7.

in from 5 to 6 hours. It is equally effectual to treat for an hour or an hour and a half on successive days until the desired amount of radiation is given.

In any one case, the treatments internal and external can be given individually or combined in varying dosage. At least seven weeks should pass before a second treatment, and it should be omitted if amenorrhœa is already secured. Usually the second treatment should be an external one.

While some fibroids show marked decrease in one month or two, others disappear much more gradually. From one treatment we have seen a gradual disappearance extending over a year before its completion. At intervals of 3 or 4 months, a treatment should be given to maintain amenorrhœa and to cause complete disappearance; this is important. We now feel that if treatments are continued long enough, the chances are that a larger proportion of complete disappearances will take place. This has not, however, been tested out as yet by actual experience in many cases.

CONCLUSION

In conclusion, we surgeons ought not to be less self-sacrificing than the wise physician who struggles to put an end to the era of of drugs, toxins, and vaccines, by sanitation and hygiene. While it is our imperative duty to continue building up our surgical technique, making operations safer and carrying surgery to a successful issue in new fields, nevertheless, all of us, I am sure, are willing and anxious wherever we can do so, to commit an honorable suicide, a sort of a *hara-kiri* of which posterity will be proud, by introducing, wherever it is possible, newer methods which are better and safer than surgery.

Beginning back in the fifties of the last century, our predecessors, at infinite cost in life and pains built up the operation of hysteromyomectomy by which so many lives have since been saved, and to which also so many have been sacrificed. As long as it can be shown that an operation in a given series of cases will not only give better health, but also save lives, we can contemplate with mingled regret and satisfaction the necessary mutilations. This attitude of mind, however, is now no longer tenable, for now that we have a simpler, safer procedure at our disposal, every death in the fibroid group becomes an indictment.

Let me also emphasize the fact that if radium fails, the operation has simply been postponed without detriment. Surely the logic of the facts presented proves that henceforth radium rightly demands the first place in a determination of the best method in a given case.

ILLUSTRATIVE CASES

Twelve typical cases are appended, in some detail. The first six consist of uncomplicated fibroid tumors of the uterus; the last six consist of cases with some serious systemic complication, such as heart disease, diabetes, Bright's disease, etc.

CASE 1 (No. 334). Mrs. C. E. D., age 40, admitted October 20, 1913. Diagnosis: uterine fibroids; slight menorrhagia.

Examination revealed a large fibroid tumor outlined on crinolin reaching to the umbilicus. It had been noted for 2 years and had been growing rather rapidly. There had been a slight increase in menstruation but no other disturbance.

On October 20, 1913, 60 milligrams radium

element were applied within the uterus for 26 hours; 60 milligrams of radium element on the abdomen for 11½ hours. The patient suffered the usual nausea and discomforts for 24 hours. In November she had a regular menstrual period, a little less than normal, no pain; no period in December, none in January. December 29, she was examined by her physician who found the uterus as big as a medium-sized orange and entirely within the pelvis. On June 23, 1914, examination showed the following: "There is still, perhaps, a small fibroid present, but certainly nothing that can give any trouble."

CASE 2 (No. 681). Miss B. S., age 29, admitted March 16, 1914. Diagnosis: uterine fibroid; menorrhagia.

Examination showed the uterus to be the site of a multinodular fibroid mass reaching to within 1 centimeter of the umbilicus. The growth is 15 centimeters in longitudinal axis, and approximately the same in the other axes. It was first noticed October, 1913.

The menstrual periods are more frequent than formerly, last longer, and are more excessive.

On March 17, 1914, 300 milligrams radium element were applied within the uterus for 1½ hours; April 24, 1914, 1371 milligrams radium element on abdomen for 2½ hours.

The patient was nauseated 24 hours from the first application, and had soreness in abdomen for 10 days. She had a scant period for 5 days in April, scant period for 3 days in May, normal periods for 3 days in June. April 25, 1914, examination showed the uterus to be one-half the original size. June 18, 1914, the uterus was normal and the function of the ovaries intact.

CASE 3 (No. 1552). Mrs. D. T., age 35, admitted April 8, 1915. Diagnosis: multiple fibroids of uterus; menorrhagia.

The patient had suffered from excessive menstruation and frequency of urination.

Examination disclosed multiple uterine fibroids, extending two-thirds of the way to the umbilicus. The tumor was known to have existed 3 years.

On April 8, 1915, 510 milligrams of radium were left in the uterus for three hours.

Menstruation stopped and had not returned when July 9, 1917, she wrote that her doctor had examined her and found no tumor. She was well but suffering with severe hot flushes.

CASE 4 (No. 1964). Mrs. F. S., age 43, admitted October 11, 1915. Diagnosis: uterine fibroid; menorrhagia, the last period lasting 20 days and still continuing.

Examination disclosed a fibroid reaching half way to the umbilicus. She had had a vaginal myomectomy several years before.

On October 20, 1915, 271 milligrams were placed in the uterus and left for 2 hours. On December 21, 1915, 435 milligrams were given for 2 hours within the uterus.

The bleeding continued after the first treatment but was stopped by the second. On February 11, 1916, the patient was examined and no tumor found. She complained of hot flushes.

CASE 5 (No. 2421). Miss S. E. H., age 40, was admitted April 14, 1916. Diagnosis: uterine fibroid; slight increase in menstruation.

The menstrual periods used to last 4 to 5 days, but they now last 1 to 2 days longer. She is very nervous.

Examination disclosed a fibroid reaching one-half way to the umbilicus.

On April 15, 1916, 532 milligrams were given intrauterinely for 3 hours, and 698 milligrams on the abdomen for 3 hours.

There was one free flow after radiation, one partial, none since. November 18, 1916, the patient was examined and no tumor found. On July 16, 1917, she was in excellent health, engaged in active work, and had no menopausal symptoms.

CASE 6 (No. 2845). Mrs. J. E. M., age 51, admitted October 12, 1916. Diagnosis: uterine fibroid; menorrhagia.

Eighteen months ago menstruation became irregular and too frequent; is nervous.

A multinodular fibroid uterus extending one-half way to umbilicus was found on examination.

On October 12, 1916, 700 milligrams were placed within the uterus and left for 1 hour and 20 minutes; 1067 milligrams applied to right side of abdomen for 13 hours; 1608 milligrams to left side of abdomen for 8 hours.

There was one menstrual period after radiation and then none. On March 1, 1917, she was examined and the fibroids were found to have disappeared. She complains of hot flushes and nervousness.

CASE 7 (No. 940). Mrs. J. H. B., age 43, admitted June 26, 1914. Diagnosis: uterine fibroid; *anæmia.*

The patient has had excessive menstrual flow for 2 years. She rarely goes a week without bleeding and passes large clots. She is markedly pale and weak.

Examination disclosed a fibroid extending 4 centimeters above the pubis. The hæmoglobin is 20 per cent.

On June 26, 1914, 544 milligrams were applied within the uterus for 3 hours. July 26, 1914, 544 milligrams for 2 hours. Also X-ray treatments were given abdominally.

On July 26, 1914, the uterus was about one-third its original size; July 17, her hæmoglobin was 65 per cent. January 1, 1918 she wrote that she was in splendid health and no symptoms of the fibroid had returned. She does her own housework and anything else she wants to; she has hot flushes.

CASE 8 (No. 1815). Miss B. M., age 40, admitted July 23, 1915. Diagnosis: uterine fibroid with excessive bleeding; *valvular heart disease.*

For 4 years she has had excessive bleeding at the menstrual period. For more than 2 years she has felt an abdominal tumor; it has grown 4 times as large since then.

A fibroid tumor about 10 inches in diameter,

round, globular, and freely movable reached exactly to the umbilicus.

On July 23, 1915, 200 milligrams were applied within the uterus for 10 hours; 200 milligrams to one area of the abdomen for 2¼ hours and 1909 milligrams to 3 areas for a total of 3 hours. December 27, 1915, 2388 milligrams to 4 areas of abdomen for a total of 6 hours.

Excessive hæmorrhage and severe reaction followed the first treatment. By November, 1915, the tumor had diminished one-half, she was working and feeling well. In December, 1917, her physician wrote that the tumor was hardly to be made out on examination and her old heart murmur seemed to have disappeared. She had occasional hot flushes but these were not annoying; menstruation had never returned and she was in perfect health.

CASE 9. (No. 2547). Mrs. J. H. B., age 48, admitted May 26, 1916. Diagnosis: fibroid uterus; *diabetes*. The patient has had periods almost amounting to hæmorrhages. In April, 1915, sugar was found in the urine.

Examination shows a fibroid uterus extending nearly half way to umbilicus.

On June 3, 1916, 507 milligrams were applied for 4½ hours within the uterus; 2961 milligrams for two hours above pubes, January 15, 1917, 2547 milligrams for 3 hours and 10 minutes on abdomen, November 24, 1917, 1208 milligrams for 6 hours over pubes.

September 16, 1916, the patient's physician reported that she had a period in July but none since; the tumor was one-half the original size. On July 10, 1917, she was examined and the entire uterus and fibroid were found not larger than a 6 weeks' pregnancy. She had had one or two mild menstrual periods.

CASE 10 (No. 2728). Mrs. M. H., age 54, admitted August 22, 1916. Diagnosis: uterine fibroid, *Bright's disease*.

The patient had excessive menstrual flow, and uræmic convulsions which began two years before admission.

An indefinite mass rises out of the pelvis, probably a fibroid; an attempt was made to trace it on crinolin but the margins could not be outlined clearly.

On August 23, 1916, 698 milligrams were administered within the uterus for 3 hours; May 25, 1917, 435 milligrams for 2 hours.

On December 12, 1916, her physician wrote that there had been no bleeding since September and that the tumor was one-half its original size. May 25, 1917, no tumor could be made out; however, as she had had one bleeding of moderate amount it was thought wise to treat again.

CASE 11 (No. 3291). Miss R. B., age 37, was admitted May 22, 1917. Diagnosis: large fibroid tumor of the uterus; hæmorrhages; double *mitral murmur* and dilated heart with frequent attacks of tachycardia.

The symptoms began 2' years ago with hæmorrhage. The periods came every 4 weeks lasting 10 to 12 days, with a brownish discharge between periods. On examination a fibroid tumor was found reaching 1 inch above the umbilicus.

The treatments given were entirely abdominal: May 22, 1917, 537 milligrams., 600 milligrams., and 1125 milligrams for 3 hours. May 24, 1917, 1588 milligrams for 5 hours.

May 26, 1917, 1191 milligrams for 5 hours.
May 27, 1917, 1043 milligrams for 6 hours.
May 28, 1917, 1481 milligrams for 6 hours.
May 31, 1817, 917 milligrams for 4 hours.
June 1, 1917, 820 milligrams for 3 hours.
July 25, 1917, 1400–1965 milligrams for 4 hours.
July 26, 1917, 3418 milligrams for 4 hours.
July 27, 1917, 2376 milligrams for 4 hours.
July 28, 1917, 1780 milligrams for 3 hours.
July, 30, 1917, 2066 milligrams for 4 hours.

Results: The first series of treatments reduced the periods and the bleeding. A second series was given. January 2, 1918, the patient showed marked improvement in the cardiac condition; the entire uterus and fibroid were reduced to the size of a large orange and there was no irritation of the skin.

CASE 12 (No. 3486). Mrs. W. T. B., age 55, admitted September 10. 1917. Diagnosis: uterine fibroid, menorrhagia; *bronchiectasis*.

The patient had excessive bleeding at the menstrual periods as well as hæmorrhage and discharge from lung ulcers. On examination a fibroid of the uterus was found. The uterus was 3 times normal size.

September 10, 1917, 1150 milligrams of radium element was applied for 2 hours within the uterus. The patient had one menstrual period after treatment then amenorrhœa. December 3, 1917, the husband wrote that she had no further bleeding and seemed cured; although she still suffered from the lung condition.

CANCER OF RECTUM [1]

By JEROME M. LYNCH, M.D., F.A.C.S., New York

CANCER of the rectum and colon has increased 100 per cent in the past fifteen years according to the *Report of Vital Statistics of the Registration Area of the United States.* Bloodgood has well said that in the life history of every malignant growth there has been a moment when it was surgically curable and the lesions under consideration offer no exception to this admirable axiom. To recognize and to seize upon this precious moment is no less than to control the life destinies of the affected individual.

Results of surgical treatment. Of 491 cases studied we have operated upon 335. The hospital mortality was 16 per cent. Forty-one have lived one year; forty-five two years; thirty-three three years; twenty-two four years; twenty-six five; and seventeen six years.

Patients not replying to circular letter have been classified as dead when last heard from. As in all clinics situated in cosmopolitan centers where the population is in constant flux it is impossible to follow a large number of the patients. Thus the statistics as above created are necessarily less favorable than if every case had been followed to date.

Whatever disability exists, as a result of operation, does not interfere with livelihood gaining. One of our patients who was bankrupt when his rectum and sphincter were removed, and who is incontinent at times, has made four trips to Europe and has earned over a million dollars since operation. We cannot overemphasize the plain fact that postoperative conditions, no matter how unfavorable as to function, do not interfere with the usefulness or economic independence of the patient.

Incontinence is a relative term. Its importance has been grossly exaggerated. As no horse is sound, so no human body is without defect and even great defects are compensated for by the natural endowment of the individual to meet such obligations. It is simply a question of getting used to the discomforts of a colostomy or a leaking anus; a psychological phenomenon well worthy of consideration. Think of the innumerable women torn in childbirth who have been incontinent for a quarter of a century, yet who efficiently and without affront to their families perform their daily work. Because of this psychological element we strongly prefer to have a relatively incontinent normal anus rather than to have an artificial one upon the abdomen.

This briefly is the result of surgical therapeusis in our series.

What stronger argument could there be for discussing the diagnosis and the indications? These statistics show that rectal cancer operated upon even after great delay and by poor methods is not hopeless. If with these limitations we obtain results, how important therefore is the early diagnosis and how promising the outlook for the future.

What have been the methods of study in this series of 491 cases? Of first importance is a flat contradiction of some still prevailing convictions, namely, that the operation is hopeless; that the cancer patient is cachetic or has lost weight; that age is of importance; that pain is a prominent symptom and that a tumor can always be felt. The very occurrence of these symptoms spells inoperability.

What are the important symptoms from the modern standpoint in order of diagnostic and therapeutic importance?

1. Constipation. This we believe to be the very first and earliest of all symptoms. It is undoubtedly protective in type, being perhaps the result of biologic reaction to the influence of the new-growth. There are, however, several hypotheses as to its origin depending upon the path of inhibitory transmission rather than upon its origin or occurrence. Of the latter and of its protec ive nature there can be no doubt. Certainly it is not due to mechanical obstruction of the growth.

2. Stomach symptoms. We have repeatedly referred to these as esoteric as contrasted

[1] Read before the American Gastro-Enterological Association, Atlantic City, May, 1917

to hæmorrhage and the like which are exoteric. Chronic indigestion, so frequently a sign of peripheral pathology, is just as significant of rectal cancer as of a chronic appendix.

3. Blood or bloody stools. This is usually the first exoteric sign. It can occur without ulceration, in which case it may be due to a blocking of the return circulation in the valveless veins leading to the liver. In any event hæmorrhage so commonly associated with cancer (10 per cent of our 491 cases had been operated upon previously to our seeing them, for hæmorrhoids) is a frequent source of the blood. In a large proportion of the cases, however, it is due to ulceration.

4. Frequent and imperative desire to move the bowels followed by explosive discharges of gas, blood, and mucus. This symptom is usually spoken of as the diarrhœa of cancer. It is not in reality a diarrhœa in that fæces are rarely passed.

These are the classical symptoms which every gastro-enterologist should know. Other symptoms occasionally noted are an indefinite pelvic discomfort and pain or tenderness over the cæcum which has been mistaken for right-sided pathology.

Diagnosis. A patient presenting any one of the above symptoms should have a rectal and proctoscopic examination as a matter of routine. In our series of 491 cases, 56 per cent of the tumors were within 7.5 centimeters of the anus; 69 per cent were within 10 centimeters of the anus and 31 per cent were oral to this. It is quite evident, therefore, that more than one-half were within reach of the finger, that two-thirds could have been diagnosed under anæsthesia by the finger, and that all except the sporadic cases in the colon could have been diagnosed by the proctoscope.

The duration of symptoms for this series was eight months. During this period many of the cardinal diagnostic symptoms already referred to had been present, so that at any time a diagnosis could have been made had the patient been properly examined.

Age. In our series of 491 cases 4 per cent were under thirty years of age; 7 per cent thirty-five. According to the United States Bureau of Vital Statistics 0.5 per cent of the cases of rectal and colonic cancer were in children under nine years of age, 2.75 per cent under nineteen years, proving that cancer is not confined to any age, and that while it occurs more frequently in middle life still for all we must recognize the danger of placing too much importance on age.

A word must be said regarding the pernicious habit of biopsy for diagnosis. In the symposium on "Inoperable Cancer" at the New York Academy of Medicine, Robert Abbe remarked that in the treatment of carcinoma by radium, the biopsy wound itself was one of the last to heal and was very stubborn.

Treatment. Operability. In our series of 491 cases extending over a period of nineteen years, 153 were considered inoperable. Of great importance is the history of the advance of our technique and a more liberal understanding of the possibilities. From a study of unexpected results in many so-called inoperable cases, we are convinced that even in the late cases, except when the peritoneum is involved, there is always a fighting chance. Of the 153 cases considered inoperable, none has been so classified because of the extent of involvement in the rectum itself.

Our operability for the total number is 60 per cent. This high percentage is due to the fact that Tuttle kept no record of inoperable cases. By operability is understood radical extirpation of the growth. In the past five years our operability has risen to 74 per cent. Let it be clearly understood that this refers to growths strictly localized in the rectum. As to the indications for radical treatment when adjacent organs are involved, our statistics show that we have often removed a part of the vagina, a part or the whole of the prostate, seminal vesicles, urethra and uterus, several coils of intestine and part of the bladder. In many instances it is necessary to perform an exploratory laparotomy to determine whether the growth is operable.

Choice of operation: (1) *combined*, (2) *perineal*, (3) *abdominal*. We have performed the combined operation 111 times; in 36 of these cases it was performed in two stages. It is our operation of choice.

The perineal has been performed 102 times; the abdominal 20. Formerly we used the fol-

lowing operations now in disuse: Kraske, 20; modified bone flap, 32; and intrarectal, 18. When possible, for the psychical reasons already described, we always place the anus at the normal site. We prefer to perform the operation in one stage if it is possible, but, if necessary, we divide it into two stages.

The perineal operation is our operation of choice in very fat or in extremely debilitated people. In all cases, as a matter of routine, we always remove the coccyx. Preliminary colostomy is always done when the growth is within 2 centimeters of the anus, in order to prepare for the extensive removal *en bloc* necessitated by lymphatic involvement.

We have for some time abandoned rectal resection for the reason that in all of these cases the operation has been followed by stricture. This is due to the presence of a terminal blood supply in the rectum rather than, as commonly supposed, to the absence of peritoneum. Exceptional work on dogs has been done by Barber which has confirmed us in this belief. It is the ischemic rather than the peritoneal denudation that produces the stricture. It is axiomatic that the amount of scar tissue is in reverse ratio to the blood supply.

Palliative operative treatment. What can be done in this type of case is still of great importance. Until earlier diagnoses are made many cases will continue to fall in this class. If this paper served no other purpose than to convince the profession of the necessity of early colostomy in inoperable carcinoma of the rectum, it will have done some good. The fixed attitude toward colostomy is that it should be postponed until obstruction supervenes. This is certainly not in accord with the facts as we find them in 36 cases, for cancer alone, and in more than 100 for other conditions. It can be done under local anæsthetic.

What are the advantages of early colostomy, in inoperable cancer, as opposed to the supposed disadvantages? It reduces the inflammation, often converting an inoperable into an operable case. It obviates intestinal obstruction and its accompanying symptoms of pain, constant secretion and defæcation, permits rest and sleep and insures recuperation. The patient renews his normal routine as to habits and diet. It stops hæmorrhage. In short, it places the parts at surgical rest. If early it is without notable mortality; if late this rises to 40 or even 50 per cent.

Local cauterization. This is frequently of great value; it stops pain and limits secretion and odor. If frequently repeated it may keep a patient alive for many months.

Treatment by radio-active substances, fulguration, and by biochemical derivatives is not here considered.

CONCLUSIONS

1. We would urge that digital and proctoscopic examinations be made routine in all patients presenting gastric or intestinal symptoms. If this is done a great many cases will be diagnosed early and saved.

2. That all cancer cases should be referred to a surgeon, as he is best fitted to pass judgment as to whether they are suitable for operation or not.

3. If operable, colostomy should be performed as soon as possible, thereby saving much suffering and discomfort.

4. That no patient should be denied a radical operation until it is proved beyond doubt that it is not justifiable.

5. That our technique is now more perfect and consequently we are saving many cases which previously died from shock and peritonitis.

A PRACTICAL METHOD OF FOREIGN BODY LOCALIZATION

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FOREIGN bodies in war surgery may be grouped into two classes: first, those of fresh wounds which are operated upon and removed at or near the front, and second, old foreign bodies which are those that have for one reason or another been passed to the rear without removal. The radiologic technique close to the front is practically all fluoroscopic. Where scores of wounded are continually passing through, speed is a most important factor, and if results are to be satisfactory, accuracy must be maintained. When one realizes that there may be numerous foreign bodies in a single patient, that they may be grouped or scattered, some movable, others difficult of access, and still others complicated, that time given to each case must be reduced to a minimum, then some of the difficulties and problems can be appreciated that must be met in war service as compared to civil practice.

Much progress has been made in foreign body localization during the war, for various methods have been perfected, considerable apparatus has been devised, and special tables which combine localizing and operating have been developed. These tables mark a great stride in advance. Methods for foreign body localization are often complicated or the technique is extensive. They may involve mathematical problems, the making of plates, the drawing of diagrams, the setting of apparatus, the removal of the patient and also the measurement of distances such as from the screen to the skin, the tube from the table, the excursion of the tube and the excursion of the shadow on the screen. Profundometers, the Hirtz compass, Sutton's spears, *l'ecran perce* of Hirtz and Gallot, etc., all have their value and uses but there are two factors which stand apart and must be considered if good results are to be obtained: first, accurate depth localization; second, the operation should be performed with radioscopic guidance.

The latter will always lead directly to the foreign body, will follow a movable body and will indicate any change of position that may be caused by the dissection or retraction.

In the removal of old foreign bodies, the speed of localization is not so important; consequently more complicated devices may be used for special cases that require more detail and deliberation, such as the making of plates, the setting of a compass, etc. Yet a practical and simple apparatus is always desirable for routine work. The method of operating is a matter of selection by the surgeon.

The method herein described will enable the operator to ascertain the depth of foreign bodies in a simple practical manner, eliminating all mathematical problems, the reading of compilation of charts, at the same time minimizing the technique and thereby removing many possibilities of error. It is not necessary to know the distance of the tube from the patient, nor the distance from the screen to the skin, nor the distance the tube moves on a horizontal plane. Any actual measurement of these factors may be disregarded, yet the correct depth of the foreign body may be read on a scale of millimeters immediately after the operation is completed.

This method is based on the fact that the two opposite sides of the parallelogram are equal in distance, one from the other, as described by Barret and Andrault. Figure 1 shows that if a straight line is drawn from H directly to the center of the circle a continuation of the same line will intersect the horizontal line D-D' at point F, which is a certain definite distance from the central vertical line A-A', as will also point H bear a definite relation to line A-A'. Another line drawn parallel to the line H-F, but passing through a point on the periphery of the circle exactly above the center will intersect horizontal line E-E' and the line C-C' at the same distance from the central line A-A' as the

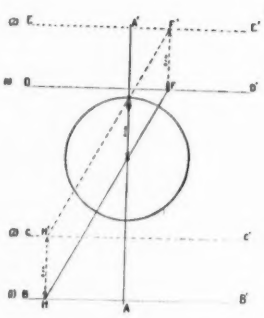

Fig. 1.

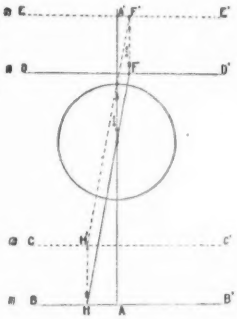

Fig. 2.

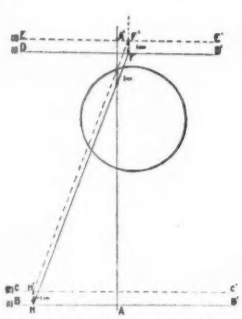

Fig. 3.

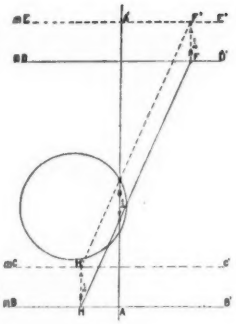

Fig. 4.

first line *H-F*, if the horizontal lines Nos. 2 are an equal distance from lines Nos. 1, each of which must be equal to the distance from the center of the circle to the periphery. In other words, if point *H'* is to be the same distance as point *H* from line *A-A'*, the distance from *H* to *H'* must be the same as from the center of the circle to the point directly above on the periphery of the circle. If point *F* is the same distance from line *A-A'* as point *F'*, then the distance between *F* and *F'* will be equal to the distance from the center mark to the periphery mark of the circle. The distances between these three sets of points will equal each other.

A working application to this diagrammatic sketch, Figure 1, may be indicated by assuming that the circle is the patient. The point in the center of the circle is the foreign body, and the line *D-D'* is the fluoroscopic screen above the patient. Point *A* will be the first position of the X-ray tube, giving the central ray in a vertical line upward directly to the foreign body (center of circle), shadow of which will appear on the horizontal screen at point where line *A-A'* crosses line *D-D'*. If a piece of opaque substance is placed at the periphery of the circle directly over the foreign body, the shadows of the opaque marker and foreign body will be superimposed, showing only one shadow on the fluoroscope *D-D'* over central ray *A-A'*. While the fluoroscope remains absolutely fixed, the tube is next moved on a horizontal plane from point *A* to point *H* and fixed there. This may be termed the second position. The central ray passes vertically upward from this point, *H*, and the foreign body at center of circle now interferes with an oblique ray throwing a shadow on the fluoroscope *D-D'* at point *F*. The opaque marker also throws a shadow upon the fluoroscope which is disregarded for the present. A small piece of lead, other opaque substance or a set of crossed wires may be used on the screen to locate precisely the shadow of the foreign body at point *F*. This spot so marked is to remain fixed in its position when the shadow of the foreign body passes on with the next movement. The tube as described above has been fixed on the horizontal plane in the second position and can be placed in the third position only when the tube and fluoroscope are so arranged on a standard or table that they both move simultaneously as a solid body when raised in a true vertical line. It must be so raised until the shadow of the opaque marker on the skin (periphery of circle) coincides accurately with the spot marked on the screen that has been fixed at point F. When this has been accomplished, point *F'* and the third position have been established. The distance that the screen and the tube has been raised will be equal to the depth of the foreign body (center of circle) from the point marked on the skin (periphery of circle).

Figure 2 when compared with Figure 1, shows the horizontal excursion of the tube from the first position *A* to the second position *H* considerably more restricted, yet the distance that the tube and the fluoroscope have to be raised in order to be placed in the

third position, is exactly the same as in Figure 1, that is, the distance from the lines Nos. 1 to the lines Nos. 2 in both cases is the same. In this way, the fact is demonstrated that the horizontal movement of the tube from the first to the second position is variable; consequently there is no necessity for measuring the distance, but the greater the excursion the more the shadows travel on the fluoroscope and the more readily is made the adjustment of the third position; the more the excursion is restricted the less the shadows move on the fluoroscope and the more exact will have to be the technique. A movement of fifteen to twenty centimeters has been found very satisfactory.

Figures 3 and 4 show that the method may be applied to all parts of the body and at every depth, but the central ray must always be used directly under the foreign body as shown by vertical line *A-A'*. In Figure 3, the foreign body is near the top of the circle and somewhat to the left side. Figure 4 shows the foreign body in the lower portion of the circle and further to the right side. By comparing Figures 3 and 4, it will be noted that in Figure 3, the source of the ray or line *B-B'* is a considerable distance below the circle; and the fluoroscope or line *D-D'* is quite close above the circle. In Figure 4 the reverse is shown; the line below *B-B'* is closer to the circle and the line above *D-D'* is farther above the circle, yet the distance the tube and fluoroscope is moved from the second to the third position is equal to the depth of the foreign body in each case.

Figures 1, 2, 3, and 4 demonstrate the following: that the depth of the foreign body is equal to the excursion of the fluoroscope when the tube moves simultaneously with it from the second to the third position; that the distance the tube is moved on the horizontal plane from the first to the second position need not be measured; that the actual distance of the tube below the patient is variable; that the distance from the skin to the fluoroscope may be optional and adjusted at the convenience of the operator; and that all depths of foreign bodies in every location may be determined.

Figure 5 represents the working application

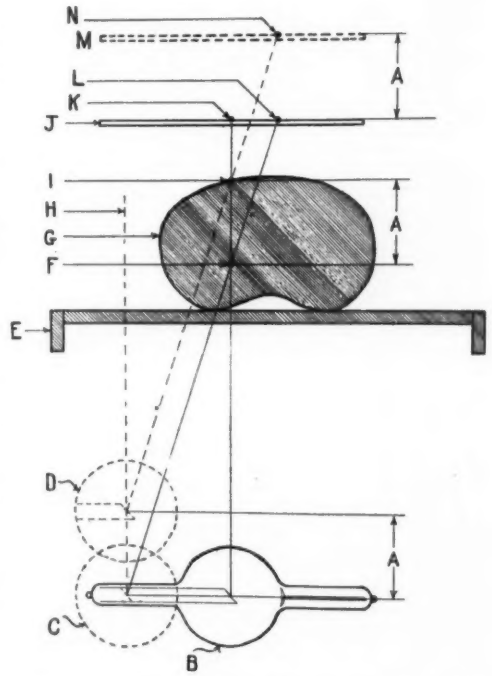

Fig. 5. *A*, Equal spaces between excursion of tube, excursion of fluoroscope and distance from skin to foreign body; *B*, tube in first position; *C*, tube in second position; *D*, tube in third position; *E*, table; *F*, foreign body; *G*, body of patient; *H*, central ray from tube in second position; *I*, opaque marker placed on skin directly over foreign body on central ray; *J*, fluoroscope in first and second positions; *K*, shadow on fluoroscope of both foreign body and opaque marker placed on skin; *I*, shadows which superimpose each other; *L*, shadow on fluoroscope of foreign body with tube in second position; *M*, fluoroscope in third position; *N*, shadow of opaque marker on skin with tube in third position. Spots *N* and *L* register exactly the same upon the fluoroscope.

of this method showing the X-ray tube, table, fluoroscope, patient, and foreign body. The tube *B* is in the first position with the central ray passing in a vertical direction to the foreign body *F* in the body of patient *G* which foreign body offers an obstruction to the ray, casting a shadow on the fluoroscope in the first position *K*. Point *I* on the skin is next established with the aid of the central ray, a metallic pointer or guide on the skin and fluoroscope. This will be exactly above the foreign body so the shadow of the opaque marker placed on the skin at this point and

the shadow of the foreign body will be superimposed at the point *K* on screen *J*. The tube is next moved on a horizontal plane to the second position *C* which will send the central ray directly upward, *H*, but the foreign body will obstruct an oblique ray from the tube in the second position that will throw a shadow on the screen *J* at point *L*. When the tube and screen are simultaneously raised on the same vertical carriage from the second position *C-J*, the shadow of the foreign body will leave point *L* and will be disregarded while the shadow of the opaque marker on the skin *I* will approach the registered spot on the screen point *L* where the shadow of the foreign body was and the carriage must be raised until this shadow is exactly centered on the spot which is indicated by the intersection of two cross wires *N*. Point *N* on screen *M* is the same spot as point *L* on screen *J*. The screen has merely been raised with the tube. This completes the operation and is called the third position.

The apparatus with which the practical application of this method has been proved was affected by slight improvised additions to the Waite and Bartlett erect tube standard. The arrangement was very crude, a photograph of which is shown in Figure 6. The additions made were the fixation of the fluoroscope *A* to travel vertically with the tube *B*, a guide *C* on standard so that the carriage of the tube and fluoroscope should travel in a true vertical line, and a measure *E* in millimeters on the immovable standard post with an index *F* on the movable carriage *G*. Figure 7 shows the application of this modified tube stand so that it may be used with any ordinary fluoroscopic or wooden table. The table should be stationary (without wheels) for any decentralizing movement of the table or patient during the operation would result in a false reading. The method that the operator employed for marking the point on the skin directly over the foreign body using the central ray in the first position, is shown, (see metallic pointer *I* in hand of operator). A lead screen may be used in front of the operator from the floor to the level of the table. With any foreign body localization, the screen work is most important. It is best, therefore, so to arrange the apparatus that both speed and accuracy will be developed. One that will answer the requirements is found in a modified Dessane's screen as shown in Figure 8. The screen is set in a frame which permits a horizontal movement in a transverse direction to the length of the table. Upon the glass of the screen are fixed two wires which cross at the center point of the screen. The shadow of the foreign body is located with the central ray and placed so that the center is at the intersection of the cross wires with the screen in the central or neutral position (see point *K*). The screen is raised on hinges (see *A*), the horizontal bar is placed in position and the pointed director is passed through the central sleeve down to the skin. The opaque marker which is on a piece of adhesive with the center hole corresponding with a hole in the adhesive, is placed under the point of the director and fixed to the skin (see *I*, Fig. 8). The director and cross bar are next removed, the screen replaced and the central ray used again to ascertain if the shadows of the foreign body and opaque skin marker correctly superimpose each other, thereby verifying the accurate placement of the marker (see point *K*), which is the screen picture of the first position. The tube is next placed in the second position which moves the shadow of the foreign body away from the center. The screen is now moved horizontally so that the cross wires again pass through the center of the shadow of the foreign body. This registers the point on the screen which is fixed for the second position *L*, Figure 5, and the third position *N*, Figure 5, as it is also the same spot that the shadow of the foreign body leaves and the shadow of the opaque marker *N*, Figure 8, takes its place at the completion of the third position. It is better to use a screen such as is described above, but not essential. One may use any screen if provision is made for registering the shadows and also if provision is made for placing the opaque marker accurately on the skin.

Figure 9, shows the sketch of a Gaiffe military, radiologic table used for localizing the depth of foreign bodies and also for operating with fluoroscopic guidance. This sketch

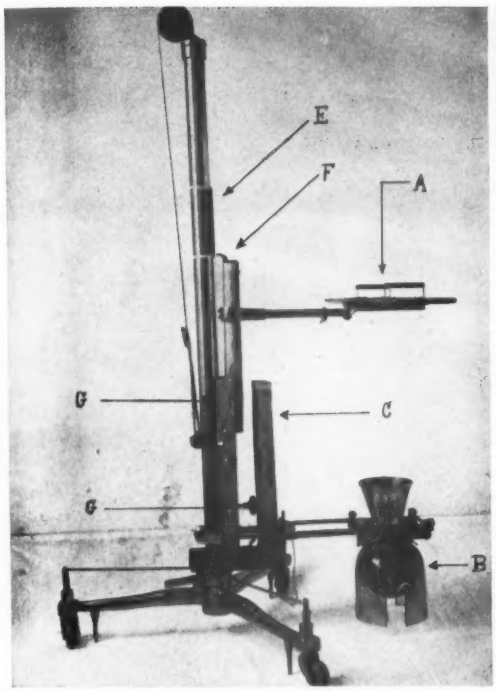

Fig. 6. Apparatus assembled for foreign body localization.

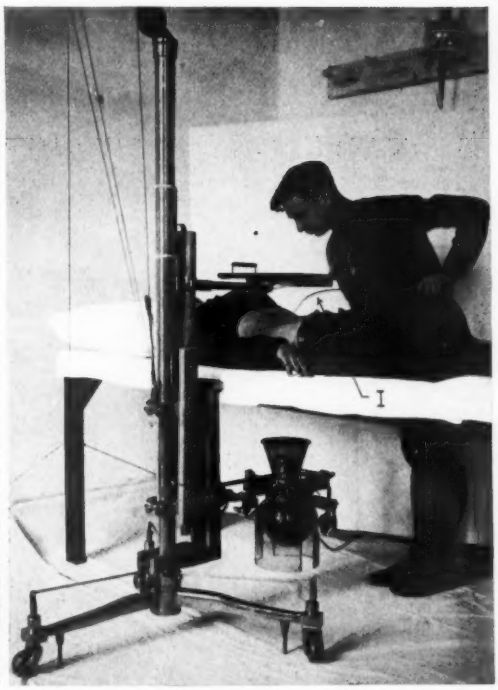

Fig. 7. Showing application of apparatus.

shows the table so modified that the method herein described may be used with it and still the original purpose of the table is not in any way interfered with. The table is made so as to be portable, with folding legs and detachable parts. The carriage sleeve *A* which carries the fluoroscope and tube in its verticle excursion, rides on the outside erect rod *B*. The fluoroscope arm is adjustable in height by a tight clamp on the carriage sleeve and carries also a sliding clamp that encircles the inner erect rod or guiding rod C. The arm holding the tube is attached to the lower end of the sleeve by a thumb screw and this also has a sliding clamp which passes around and rides on the inner, erect or guiding rod. The carriage carrying the arms, is raised (or lowered) from the second to the third position by the cog arrangement of hand wheel *D*. The tube when placed in the holder, must be centered on the smallest possible aperture of the diaphragm with the aid of an opaque plumb-bob or apparatus made for adjustment of the central ray, so that the tube may remain centered and always be ready for use without further adjustment.

The apparatus is arranged in such a way that a search for foreign bodies may be very quickly made over any part of the whole body, the tube may be placed under any particular foreign body, and the foreign body may be placed over the central ray by using a small aperture in the diaphragm. The diaphragm is enlarged and the fluoroscope is placed so that the first position of the foreign body shadow is registered by cross wires on screen (see Figure 8, *K*). The spot on the skin is marked (see Figure 8, *I*), and the shadows of the foreign body and opaque marker will superimpose on screen (see Figure 8, *K*). The tube is moved to the second position and the shadow of the foreign body registered

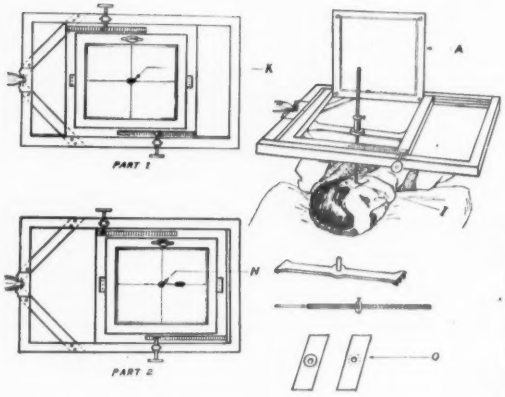

Fig. 8. Modified Dessane screen used by author.

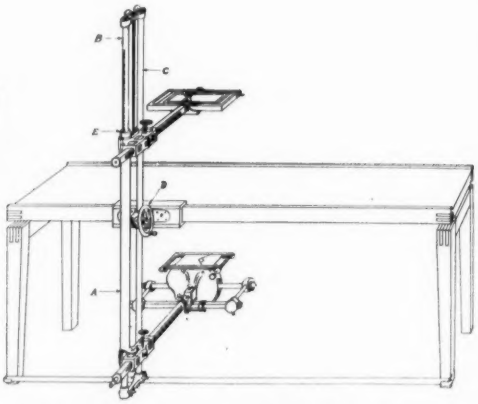

Fig. 9. Gaiffe military radiologic table for localizing foreign bodies and for operating with fluoroscopic guidance.

(see Figure 5, *L*). The carriage with the tube and fluoroscope is raised by hand wheel until the opaque marker on the skin registers on the fluoroscope at the same point, Figure 8, *N*, as the shadow of the foreign body did in position two, Figure 5, *L*. The reading is taken at the top of the sleeve, *E*, on the erect rod, *B*, which is graded in millimeters and this reading will be the depth of the foreign body (in millimeters) from the point marked on the skin.

All methods of foreign body localization require intelligent and accurate technique. The slighest deviation from the point of true accuracy is not to be tolerated. Practical experience is of great value in this work and often one may develop a "foreign body sense." Particular attention should be paid to the following:

1. Locating the spot on the skin. This is found by the shadow of a metal director or skin marker which is observed by the operator while looking at the screen and who guides the point of it on the skin so that the point superimposes the exact center of the foreign body shadow over the central ray. The Dessane screen method for skin marking may also be used (see Figure 8, *I*).

2. A flat metal disc with a hole in the center, such as a small rivet-burr is placed upon a strip of adhesive plaster with a hole in the adhesive corresponding with the center hole of the disc. This is placed accurately over the point on the skin which has been previously located and marked so that the mark on the skin is exactly at the center of the hole in the disc. This produces the screen picture of the first position see (part *1*) Figure 8 and point *B* Figure 5.

3. The register cross wires on screen in the second position (see point *C*, Figure 5) must intersect or cross at the center of the foreign body shadow.

4. In the third position the cross wires must intersect the center of the rivet-burr or opaque marker on the skin (see part *2*, Figure 8).

If a part of the body is moved unavoidably by respiration, the registration wires on screen may be allowed to cross at one-half the excursion of the shadow, or intersect the center of the complete excursion of the shadow on the screen. The patient need not be moved from under the screen, nor moved on the table during the operation of this method of localization. The actual finished technique with the table descr'bed will be as follows:

1. Search for the foreign body, place fore'gn body over the central ray and place the fluoroscope so that the shadow of the foreign body registers at the intersection of the cross wires at the center of the screen.

2. Mark the spot on the skin directly above the foreign body and over the central ray by placing the opaque marker carefully over this

point so that both shadows superimpose. This is the first position.

3. Place the tube in the second position and register shadow of foreign body on screen.

4. Place the tube in the third position and register shadow of opaque marker on screen.

5. Read on erect standard the depth of foreign body from point marked on skin.

Having determined the depth of the foreign body, the best results are obtained for the removal of foreign bodies when the operation is performed on a radiologic table. With the use of the X-ray, the radiologist using a metallic, sterile director and Dessane bonnet, is able to direct the surgeon both as to the point of entrance and the location of the foreign body during the operation. In this way the surgeon has the benefit of operating in unrestricted light. Another method is for the surgeon to operate in a darkened room with the aid of an orange light using the fluoroscope himself as a control at various steps of the operation. It is not usually used in cases where a difficult dissection is anticipated, but it is very useful when the foreign body is to be removed through the tract of the wound in fresh cases and when the foreign body is to be removed by the puncture method. The Sutton puncture or spear-director method may be used in cases in which the puncture is not contra-indicated. It is often desirable to use the Hirtz compass which is of very great value, but the technique and time involved for each case prevents the use of it as a routine measure on an active service.

CONCLUSIONS

In conclusion, I would urge that consideration be given the method described for determining the depth of foreign bodies because of its practical value and because—

1. The screen work is similar to that used with other methods.

2. A radiological table may be so modified as to use this method without interfering with its original purposes.

3. The method may be used either on a table complete or on a separate erect tube standard.

4. Speed is facilitated and accuracy maintained.

5. No mathematical problems, calculations or measurements need be used.

6. The actual depth of the foreign body may be read in millimeters immediately the operation is completed.

INFLAMMATORY NEOPLASMS OF THE INTESTINE SIMULATING MALIGNANCY[1]

By NATHANIEL M. JONES, M.D., and A. A. EISENBERG, M.D., Cleveland, Ohio

THE differential diagnosis from gross morphology between inflammatory processes and malignant disease not infrequently presents considerable difficulty. Certain chronic inflammatory changes of the breast, for instance, Reclus' disease or chronic cystic mastitis, present grossly much the appearance of carcinoma. Chronic posttraumatic periostitis is sometimes difficult to differentiate from sarcomata; but it is in the long-standing inflammatory processes of the gastro-intestinal tract that this confusion most often arises.

Many cases of perigastritis on the base of old ulcers have been clinically diagnosticated as carcinomata. As long ago as 1853, Virchow called attention to isolated inflammatory masses in the walls of the colon. Hamann (1) has referred to gross similarity between inflammatory masses occurring around silk ligatures in herniotomies, hysterectomies, and the stump of the omentum, to malignant diseases. LeDentu (2), in 1909, published an interesting article on false cancers and inflammatory tumors in the abdomen which he divided into four categories: (1) interstitial colitis, causing circumscribed hypertrophy and stenosis; (2) simple pericolitis; (3) diffuse pericolitis; and (4) exuberant pericolitis. He instances the case of a man, 39 years of age, who had long suffered from backache, constipation, and emaciation, with blood and mucus in the stool. There was a hard tumor in the umbilical region, which was cured by the use of ice, rest in bed, and cathartics. Mayo Robson (3) says that the pathology of such tumors is that of a chronic inflammatory colitis, probably due to infection spreading through the intestinal wall, and he speaks of two varieties: the chronic adhesive, in which the onset is acute; and the chronic inflammatory, in which the onset is slow. He reports numerous cases, in five of which with patients supposedly suffering from carcinoma of the sigmoid or rectum, the growth disappeared after colostomy. He also mentions the fact that cases recovered under hot topical applications.

Studies at the Mayo Clinic seem to indicate that these masses are usually on the basis of chronic inflammatory processes around diverticula. Diverticula have been found in every part of a digestive tube from the œsophagus to the anus, and their presence frequently gives rise to inflammatory tumors. Giffin (3) reports 27 such cases, in five of which carcinomatous degeneration was found on microscopic examination. C. H. Mayo (4) reports 17 cases of diverticula of the appendix itself. Pathologically these processes give rise to marked proliferation of fixed connective tissue, either diffuse or localized in nodules, and the starting point is almost invariably the submucosa or muscularis. It is rather striking that the mucosa usually escapes unless injured by pressure atrophy brought about by contraction of newly formed fibrous tissue. Kauffman (5) lays especial stress upon the fact that histogenetically such chronic inflammatory reactions of the gastro-intestinal tract differ very materially from infections of other organs in that the mucosa is spared until late in the process. In fact McGrath (6) speaks of such conditions as "extramucosal."

As indicated above, such inflammatory processes are at times differentiated with difficulty from certain other pathological conditions; notably diffuse carcinoma and the infectious granulomata.

A striking case of this variety was recently under my care and is charged with a double error in diagnosis:

F. S., St. John's Hospital, No. 1679. A grocer by occupation, an American by birth, 23 years of age and single. Referred by Drs. John MacLachlan and H. A. Berkes. Operated upon by N. M. J.

The family history is of no importance, no case of tuberculosis or malignancy occurring in it. In his personal history, up to one year ago, there is nothing of moment. He had suffered from no

[1] Read before the Academy of Medicine, Cuyahoga County, Cleveland, December 20, 1917.

acute or chronic infectious diseases, and there has been no history of venereal infection. About July, 1916, he suffered a severe attack of pain in the right lower abdomen, accompanied by nausea, vomiting, and chills and fever, which was diagnosticated by his attending physician as acute appendicitis. He was confined to his bed ten days at that time but not operated upon. Several minor attacks of pain of short duration were suffered until about the middle of April, 1917, when he had a rather severe attack of shorter duration. Since then there have been numerous such attacks in the region of the appendix. Three days before presenting himself for examination for the selective service in August, he began to have pain again in the abdomen. This increased in severity, but on the afternoon of August 14 he presented himself for examination and Drs. MacLachlan and Berkes, the examining physicians, diagnosed an acute attack of appendicitis and referred him to me for operation. His temperature was 99.4°; his pulse 108. He was a fairly well nourished man. His teeth were in rather poor condition but there were no other evidences of oral sepsis. His pupils were equal and reacted equally to light and accommodation. There was no general glandular enlargement and his reflexes were everywhere present and normal. The heart and lungs were negative. The abdomen was not distended but presented a condition of board-like rigidity over its entire extent, with extreme tenderness in the right lower quadrant. Deep palpation of the abdomen was not possible on account of the rigidity and tenderness. He was directed to go immediately to the hospital but did not present himself until the following morning. At this time his temperature was 100.4° and his pulse 100; blood count 10,700, and the examination of the urine showed nothing abnormal. The abdomen presented the same conditions as on the previous afternoon. Operation: anæsthesia, ether, administered by W. E. Gernhart. After the patient was anæsthetized, one could palpate a large indistinct mass in the right side rather lower than McBurney's point. A McBurney incision was made and upon opening the peritoneum and introducing the hand, great difficulty was encountered in making out landmarks. After considerable search a large hard mass was felt densely adherent at about the brim of the pelvis. It was necessary to enlarge the incision and the better exposure thus obtained showed the lower ileum and the caput coli to be buried in a mass of firm adhesions. These were freed with great difficulty and it was then found that about 2.5 inches of the lower ileum and the caput coli composed a very dense and extremely hard tumor mass. The mesentery of the lower ileum was extremely thickened and numerous enlarged glands could be felt. The appendix could not be identified. The gross appearance was that of a carcinoma of the intestine, though the possibility of tubercular, actinomycotic or chronic inflammatory process was considered. The entire mass was resected and an end-to-end anastomosis was made between the ileum and the colon. Rather large raw surfaces were left which it was impossible to close. Free drainage was provided and the patient put to bed in a fair condition, though exhibiting some shock. He reacted nicely and on the second day had a spontaneous evacuation of the bowels. Five days after the operation a large amount of purulent discharge escaped from the wound on dressing. The sutures were removed, the wound opened down to the fascia, and Carrel-Dakin instillation begun. On the 2nd of September, the wound was sterile and rapidly granulating; the edges were pulled together with adhesive strapping and he was discharged from the hospital on September 15 in excellent condition; pulse normal, and appetite good. He was feeling better than for four months. It is of interest to note that during the week subsequent to his discharge he returned to the hospital with an acute obstruction of the bowels and was reoperated upon during the evening, at which time I found a dense band of adhesions passing across the anastomosis and causing a complete obstruction. This was freed and the patient reacted nicely and has been in good health ever since.

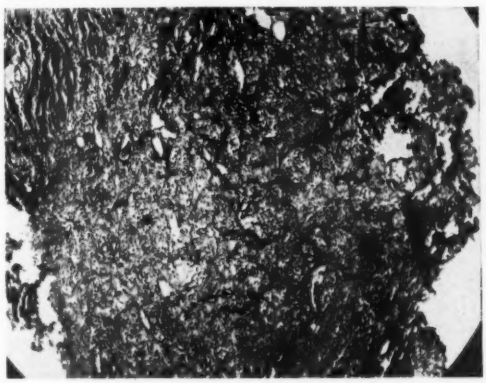

Fig. 1. Cross section of cæcum. No mucosal structures are recognizable; the glands are completely atrophied through pressure atrophy. There is an enormous increase of connective tissue everywhere and areas of round-cell infiltration.

The pathological report was that the gross specimen consisted of part of the ileum, the cæcum and part of the ascending colon; the appendix was buried under thick fibrous tissue on the anteroinferior wall of the ileum and sprang from the upper part of the cæcum beside the ileocæcal valve. The appendix was completely obliterated except for a small opening in the cæcum. This was practically a diverticulum composed of mucous membrane only; the mucosa of the ileum and cæcum was intact. The general appearance was not unlike

diffuse carcinoma, both in the hardness of the tissue and its irregular distribution. Microscopically the section showed no evidence of malignancy, tuberculosis, or actinomycosis. It presents simply a tremendous overgrowth of connective tissue.

Through the kindness of C. A. Hamann, I am permitted to report the following case, which shows points of similarity:

Mrs. E. C. P., Charity Hospital No 3312, was admitted to Hospital, June 27, 1917, with the following anamnesis. The family history shows nothing of interest except the death of three brothers and two sisters, from tuberculosis. There is no history of malignancy in the family. She had had the usual diseases of childhood. There was no history of typhoid or pneumonia. She has had two children and one miscarriage. About five months previous to her entrance into the hospital she fell down stairs striking the right side of the abdomen. Two months later she began to have pain in the right side, which would come and go. These pains were usually brought on by jarring, such as riding in an automobile. Toward the last the pains were getting much more severe, and for two weeks previous to the time of her operation, the patient could herself feel the mass in her right abdomen. On June 28, 1917, Hamann opened the abdomen through a right rectus incision. A mass the size of the fist was found in the right iliac fossa involving the cæcum and adherent to the abdominal wall. It was immovable and there was extensive glandular enlargement. The transverse colon was firmly united to the mass. It was considered at the time as inoperable carcinoma, though Hamann remarked that there was a remote possibility of its being an inflammatory tumor. Her subsequent history is interesting. She recovered rapidly from the exploration and has been progressively improving in health ever since. Her physician now reports that the wound is entirely healed, there is no evidence of the mass in her abdomen, and she is apparently perfectly well.

My friend Dr. Foldes, who was formerly assistant to Prof. T. von Verebely in Budapest, tells me that during his service Professor von Verebely encountered two cases similar to mine, in which there was an inflammatory mass involving the ileocæcal junction and for which he resected. These cases have been reported, as well as two others by von Eiselsberg's clinic, but I have been unable to find the references.

Burton J. Lee (7) reports a case which was operated upon in April, 1916, for chronic appendicitis.

Three weeks later she developed pain in the epigastrium with signs of obstruction and she was acutely ill. On examination a distinct hard mass was palpable in the epigastrium. On May 6, the abdomen was reopened and an abscess cavity was found adherent to the abdominal wall and involving the transverse colon. The gross diagnosis was that of malignant tumor of the colon and a resection was made. A pathological report by Elsner showed much thickening of the intestinal wall by hard masses of fibrous tissue incorporated with the peritoneal coat. There was a productive inflammatory process with leucocytic infiltration, showing a few giant cells. The process did not involve the mucous membrane.

Braun (8) reports three cases also in which part of the colon was excised on the gross diagnosis of carcinoma, while the pathological examination showed the process to be inflammatory.

In my case the question of differential diagnosis did not arise on account of acute symptomatology. It is probable, however, that such cases when seen in the quiescent stage would give rise to the problem of differentiating them clinically from carcinoma and the infectious granuloma. This is an important question from the standpoint of therapy, for, as indicated in Hamann's case above reported, and as is also pointed out by Mayo Robson (4) these inflammatory masses will often disappear without surgical intervention.

Giffin (3) has pointed out that the age incidence in these cases is from 40 to 65, the cancer age, which would make the diagnosis more difficult. As far as I know, my own case is the youngest so far reported. When the history of such cases is examined, however, it will usually be found that there has been repeated attacks of abdominal pain, associated with fever. The absence of blood and pus in the stool, as suggested by Giffin, points against malignancy. Should the question of lues arise, a complement fixation test might assist. No other condition gives rise to such board-like rigidity as does actinomycosis, as has been noted by Verebely (9).

The pathology of such conditions is interesting. Just as in other chronic inflammatory affections, the striking feature is the excessive overgrowth of connective tissue, with its subsequent contraction, which results in the

formation of scar tissue. The starting point of this proliferation seems to be, as has been mentioned before, in the submucosa whence it extends either inward to form circumscribed nodules, or lengthwise causing diffuse infiltrations. The mucosa, singularly enough, is not involved unless through the secondary pressure of the contracting connective tissues, causing pressure atrophy and localized coagulation necrosis of glands. Blood-vessels are markedly congested, partly because of the pressure upon their lumina and partly because of permanent dilatation of the vessels due to atrophy of the adventitia and media of the smaller vessels.

REFERENCES

1. Hamann, C. A. Ann. Surg., Phila., li, 787.
2. DeDentu. Bull. Acad. de méd., Par., 1909, lxii, 289.
3. Giffin. Ann. Surg., Phila., 1911, April.
4. Mayo, C. H. J. Am. M. Ass., 1912, lix, 260.
5. Kauffman. Die Handbuch der Gen. Pathologie.
6. McGrath. Surg., Gynec. & Obst., 1912, xv, 429.
7. Lee, Burton J. Ann. Surg., Phila., lxv, 26.
8. Braun. Deutsche Ztschr. f. Chir., vol. c.
9. von Verebely. Pest. Med. chir. Presse, Budapest, 1910, 337-339.

CONGENITAL POLYCYSTIC KIDNEY

With a Report of Four Cases Occurring in Children of the Same Mother

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THE pathology of polycystic kidney is not as yet quite clear. At various times, different authors have held diverse views as to their cause, while at present it seems to be generally conceded that the cause or causes are not definitely known.

However, there have been three theories advanced which have had considerable support, and it is thought that one or more of these is responsible for the condition. The oldest of these, known as Virchow's theory, maintains that the cysts are caused by an inflammatory process which occludes the uriniferous tubules, forming, as it were, retention cysts. This view was supported by Frerichs, Rokitanski, Roger and Virchow. At present it does not seem to be very popular.

Chotinski, Phillipson, Nauwerck, Hufschmidt, von Kahlden and others held that the cysts were a sort of adenocystoma; in other words, a distinct new formation. This theory is supported by analogy with cystic tumors elsewhere and by the histological structure of the cysts. It has many supporters today.

Hildebrandt, Hanau, Ribbert, Busse and many later investigators take the cyst formation to be either an anomaly or an arrest in development. This seems to be the most widely accepted theory, and is supported by the fact that other malformations frequently co-exist, and by the not infrequent occurrence of several cases in members of the same family. The cysts are said to be formed by degeneration of remnants of the wolffian body, or by failure of union between the excretory canals and the convoluted tubules. It has apparently been proven that these two structures are developed from separate "anlagen." In the early embryo there are a renal vesicle and a primary collecting tubule, these uniting to form a single canal, which later becomes convoluted. Should this union fail to take place, cysts will form from the renal vesicle.

Ziegler says the cysts sometimes consist of enlarged Bowman's capsules and concludes that they are a malformation rather than a degeneration. He holds that arrest in development as well as secondary processes, e.g. inflammation, may co-exist in the same case. Meyer supports the theory of malformation or lack of development and claims to have found a co existing lack of development (atresia) of the ureter in most cases.

Fig. 1. Second child. Note size of kidneys, as compared with other abdominal organs, also papular eruption on face. Black area on inside of anterior abdominal wall is a subperitoneal hæmorrhage.

Braunwerth[1] attempts to show that kidney cysts are quite common. He made a large series of autopsies on fœtus, stillborn and very young infants, and found that more than one-half of them showed actual kidney cysts. He is of the opinion that they are due to an arrest in development, based on the theory of the dualistic development of the organ. He maintains that no line can be drawn between kidney cysts and cystic kidneys,

Virchow[2] distinguishes between congenital cystic kidneys and the cystic kidney of the adult. This view has been generally discarded. It seems that an individual with polycystic kidneys often survives until the kidneys are put under an extraordinary strain, when he may succumb to uræmia. Hence many cases are discovered at autopsy after the patient has succumbed to an acute infection, the damaged kidney being unable to perform the extra work placed upon it. Our series seems to support this latter view, as one of the living children without doubt has cystic kidneys, while another would probably be alive but for an accident of childbirth.

All severe cases of congenital cystic kidneys seem to be accompanied by an ascites. In fact, polycystic kidneys are usually listed in textbooks on obstetrics as a cause of fœtal dystocia. Very little attention seems to have been paid to the cause of this accompanying condition. When we consider the extremely thickened parietal peritoneum in two of our cases, we are compelled to regard the condition as one of chronic peritonitis, rather than a mere transfusion. This brings up the question whether the cystic kidneys in some way cause the peritoneal irritation, or whether a common cause underlies both. As early as 1838, J. Y. Simpson called attention to the fact that fœtal syphilis may cause peritonitis. Ballantyne[3] says that while ascites is frequently met with in syphilis, there are numerous other causes. Unfortunately, however, he does not greatly enlighten us about them. He quotes Ohlshausen as reporting a fœtus with malformation of the genito-urinary apparatus in which he thought the leakage of urine caused a "peritonitis" which was present.

Since syphilis does cause fœtal peritonitis and has been suspected of causing certain malformations, and since one of the fœtus showed a skin eruption, a Wassermann was made of the mother's blood, but proved negative. A search for spirochætæ in the fœtal liver was likewise futile.

In submitting the following case report, it is regrettable that, with the abundance of material, we are unable to shed any new light on the cause of this condition. It is of interest because it shows that, whatever may have been the cause of the polycystic kidneys, as well as of the accompanying peritonitis (?), this cause became less potent with a surprising regularity in each successive

[1] Ueber Nieren Cysten. Virchow's Arch. f. path. Anat., etc. Berl., 1896, x, 341.

[2] Berl. klin. Wchnschr., 1892, p. 105.

[3] Antenatal Pathology, vol. 1, p. 237.

case. This regularity was not influenced by the fact that, during the third pregnancy, the mother was given antisyphilitic treatment. It will be seen from the following that this woman bore four children who undoubtedly had polycystic kidneys (Nos. 1, 2, 3, and 5). It is reasonable to suppose that No. 4 has polycystic kidneys, and also the fœtus which was lost by abortion. The last child may even have a few cysts remaining, making, in all probability six, if not seven, cases of cystic kidneys.

The mother, M. B., is a native of Bosnia, a peasant, who has enjoyed uninterrupted good health before, during, and since her pregnancies. At the time of her first conception, she was twenty-four years of age.

May 8, 1908. First delivery, gestation supposed to have advanced seven and one-half months, but the child was under-developed for that age. Parturition was impossible on account of the immensely distended abdomen, which had to be evacuated to make delivery possible.

Male fœtus (Fig. 2) had an abdomen filled with a clear yellowish fluid. The transverse diameter was the greater. The peritoneum was thickened, especially that covering the parietes, which was leathery and so tough that its rupture was almost impossible. There were some adhesions between viscera. The abdomen was divided into compartments by adhesions. The kidneys were of immense size, completely joined at their lower poles.

January 30, 1909. Well developed male child (Fig. 1). Abdomen had to be drained to permit delivery. There was a papular eruption on the face. The abdomen was large, but not so large as No. 1. The parietal peritoneum was quite thick and dense, but less so than in the first case. The visceral peritoneum was normal, except that covering the kidneys. There were few adhesions. The kidneys were very large, as seen in the illustration.

July 4, 1910. Male child, born at full term. Antisyphilitic treatment had been administered during the entire pregnancy. The abdomen was again too large to permit delivery, but much smaller than in the case of the previous two. The kidneys were cystic and quite large. The peritoneum was

Fig. 2. Outline drawing of first child, showing relative size of abdominal organs.

thickened on the abdominal wall, but otherwise normal.

November 22, 1911. Female child, apparently healthy and normal. Delivery spontaneous. The child has weathered an attack of measles, of whooping cough and of bronchopneumonia. While not robust, and somewhat small for its age, it is today alive and well.

August 10, 1912. Abortion at four months. Unfortunately the fœtus had been destroyed before my arrival.

September 4, 1914. Sixth pregnancy, full-term male child, well formed, with abdomen not enlarged. Delivery spontaneous but slow, on account of face presentation. A midwife was in attendance and the child was stillborn, probably due to tardy delivery, as there was no apparent reason why the child should not be viable.

At autopsy nothing abnormal was found except polycystic kidneys, the right weighing 40 gm., the left 17 gm.

November 25, 1915. Spontaneous delivery of full-term male child, which is alive and robust at the present time.

ROENTGENOLOGIC ASPECTS OF HOUR-GLASS STOMACH

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From the Mayo Clinic

THE increasing use of the roentgen rays in the diagnosis of gastric disease and the ease with which deformity of the gastric contour can be thus determined have resulted in a greatly increased number of correct diagnoses of hour-glass stomach. But, as might be expected, it may also happen that after the roentgenologist has made a confident report stating that hour-glass was present, the operating surgeon will occasionally find that such is not the case, and it is for this reason that, after a few disappointments of this kind, some surgeons have been inclined to question the value of roentgen findings in the diagnosis of this deformity.

In order to clear up misunderstandings in connection with the matter, it seems timely to review the entire subject at some length, even though facts are repeated that are well known to the initiated.

While hour-glass deformity of the stomach is admittedly not a disease entity, it possesses more or less distinctive pathologic importance and, were there no other reason, its striking title alone would give it a separate interest in medical literature.

Accurately speaking, the hour-glass stomach is simply an occasional end-result of various gastric lesions, but the nature of this end-result materially affects the symptomatology, diagnosis, and treatment of the causative disease. With the development of roentgen diagnostics the detection of this deformity has become far less difficult than formerly, and the subject is therefore of particular moment to the roentgenologist.

The term "hour-glass" defines itself, and for the purposes of this paper we shall apply the term to every stomach with a locally constricted lumen anywhere between the pylorus and the cardia, whether this is due to organic change, or to spasm, or both.

In the present study the intention is to deal with the subject chiefly from the roentgenologic standpoint, which necessitates a brief preliminary discussion of the etiology, pathology, and clinical diagnosis.

As to etiology, the time-honored classification of hour-glass stomach into congenital and acquired can hardly be discarded, even though the existence of the former is doubted by some. Notwithstanding the cases reported and the supporting theoretical arguments offered, congenital hour-glass stomach is a rare condition, and it is this extreme rarity that makes the subject of little practical interest especially to the roentgenologist who can hardly differentiate between these two types. For this reason, too, it will not be discussed further on the present occasion.

In a general way, acquired hour-glass stomach may be grouped into two classes, *organic* and *spasmodic*.

In the organic type the constriction is due to permanent structural changes either in or about the gastric wall. The stenosis thus produced is often increased by spasm of the circular muscle fibers, but regardless of this fact the condition is essentially organic and stable.

Gastric ulcer, either of the perforating or penetrating type, stands first in the etiology. By perforating against an adjacent organ, most often the pancreas or the liver, the stomach is not only fixed at that point but the resulting adhesions may involve a considerable portion of the neighboring gastric periphery. Following this fixation and local transverse contraction, the weight of the food probably tends to produce a sagging of the loculi, exaggerating the proportional narrowing of the isthmus. When the ulcerative process, without an immediate sealing off, as sometimes occurs, continues to excavate the tissues outside the stomach, resulting in an accessory pocket, it is frequently but not invariably associated with hour-glass stomach. Penetrating ulcers may also give rise to hour-glass constriction by infiltration and cicatricial contraction, though less often than

the perforating variety. The ulcers giving rise to hour-glass contraction are most commonly seated on the lesser curvature, less frequently on the posterior wall, and usually in either event in the middle third of the stomach. Generally the constriction occurs at the expense of the greater curvature which is drawn sharply toward the lesser curvature, while the latter holds its usual position. The indentation of the greater curvature is, as a rule, relatively narrow, resulting in a correspondingly short isthmus along the lesser curvature, which gives the deformed stomach a semblance to the capital letter B.

There are occasional striking exceptions: An ulcer on the greater curvature may be accompanied by an indrawing of the lesser curvature; an ulcer in any situation may contract the walls of the stomach in the plane of its site; the isthmus, instead of being short, may be relatively long. The width of the canal is, of course, variable, but even when it is quite narrow, the constriction is nearly always sufficiently emphatic to be readily noted.

Gastric syphilis, which is more often recognized now than in the past, probably ranks second to simple ulcer in producing hour-glass stomach.

Gastric cancer, as a causative factor in hour-glass stomach, probably ranks next in importance; but this has been found to be an accompaniment in less than 1 per cent of the cases. The cancer may be of the annular type, encircling and constricting the gastric circumference; or, if localized at either curvature at the anterior or posterior wall, it may produce contraction of that segment of the stomach. Again, a cancer mass projecting into the lumen of the stomach may divide it into two chambers. Sarcomata or benign growths may cause a similar biloculation, but such tumors are not of common occurrence.

A hyperplastic form of tuberculosis is occasionally met with in the stomach, the process involving the pyloric end of the stomach without hour-glass deformity. However, tuberculous ulcers, which are often multiple and seated in the midstomach, may constrict this portion (Fig. 1).

More or less contraction may ensue following certain operations, notably gastrostomy, gastro-enterostomy, sleeve resection or local excision of gastric lesions (Fig. 2). After gastrostomy or sleeve resection the contraction may be fairly pronounced, but after gastro-enterostomy there is usually no constriction unless a gastrojejunal ulcer develops or extensive adhesions form (Figs. 3 and 4.)

Hour-glass contraction has resulted from scarring due to corrosive chemicals, such as muriatic acid, as in a case reported by Klein (11).

Perigastric inflammatory processes of various kinds may produce bands or adhesions and cause hour-glass deformity. Occasionally cases of hour-glass are found to be caused by a single adhesion band of unknown origin (Fig. 5). In Elder's (4) case the stomach was drawn up by a ligamentous band from the right rectus muscle. Mayo Robson (13) mentions an instance in which the stomach was trilocular, one constriction (the proximal) being caused by a band of adhesions from the liver to the transverse colon, while the other stenosis was due to the cicatrization of a chronic ulcer.

Conflicting statements have been made as to the relative size of the two pockets in organic hour-glass, particularly the common form due to ulcer. Tuffier and Roux-Berger (20) generally found the narrowing to be nearer the pylorus than the cardia; hence the upper pouch was the larger. On the other hand, Eusterman (5) found the lower loculus to be the larger in a considerable series of cases. Roentgen examination of the cases in the Mayo Clinic for five years past would indicate that in the majority of instances the upper pocket was the larger, but this discordance in observations is rather immaterial. Moynihan (14) has found that the proximal portion has thicker walls than the pyloric portion and is larger by reason of dilatation and hypertrophy.

Among the complications of organic hour-glass, volvulus has been observed by Hermes (9) and Reinecke (16). In Hermes' case the hour-glass constriction was the size of a finger. The pyloric loculus had rotated on its long axis, protruding through a slit in the

mesocolon. In Reinecke's case also, there was a volvulus of the pyloric segment, causing complete stenosis at the hour-glass constriction.

Referring to *spasmodic* hour-glass stomach, the rôle played by spasm in the production of this condition has become better understood with the increasing employment of the roentgen examination. Surgeons have sometimes noted peculiar spastic manifestations in the stomach during operation. For example, W. J. Mayo, while operating, has on several occasions seen such spasms in which the stomach slowly contracted, the gastric wall became thick and blanched, and then as slowly relaxed again. But the significance of this spasm was not appreciated until the roentgen ray and the opaque meal came into common use. One of the earliest discoveries was the fact that the barium-filled stomach sometimes showed a spasm of the circular muscle fibers in the plane of a gastric ulcer, thus producing an indentation on the opposite curvature, the incisura. Later, more diffuse forms of spasm were recognized and the whole subject of gastrospasm became an important chapter in gastric roentgenology.

The particular forms of spasm producing hour-glass stomach may be classified as *intrinsic* and *extrinsic*.

Intrinsic spasm is a convenient designation for spastic contraction of the gastric musculature arising directly from a lesion of the stomach itself. In the majority of cases the lesion is an ulcer, and most often the circular fibers chiefly are affected (Fig. 6). When the stomach is filled with barium, the spasm is roentgenologically observed opposite the ulcer as a local indrawing of the curvature, commonly the greater. It is in this form that the indentation may be relatively slight in some cases or so deep in others as almost to bisect the stomach. Cancer may also produce a similar local spastic indrawing of the gastric wall (Fig. 7), and spasm is probably accountable in some cases for the hour-glass contraction accompanying tuberculous and syphilitic lesions.

The view has been expressed by Moynihan (14) and by Reizenstein and Frei (17) that in many cases of organic hour-glass stomach the narrowing is exaggerated by spasm. This is unquestionably true.

Extrinsic spasm is either produced by lesions outside the stomach or is at all events accompanied by such lesions. It is an occasional cause of hour-glass deformity, as seen roentgenologically, and has been frequently noted in association with duodenal ulcer, disease of the gall-bladder or appendix, and sometimes in hysterical or other nervous states.

The purely spastic hour-glass deformity, whether of intrinsic or extrinsic origin, is rarely present at operation because of the relaxation produced by the anæsthesia, and for this reason the roentgenologist is sometimes wrongfully accused of a maldiagnosis.

As to symptoms and signs, the clinical literature of hour-glass stomach is most exclusively devoted to the organic form. Agreement is general that the symptoms alone are not diagnostic. They may point rather definitely to ulcer, the most common causative lesion, but seldom suggest the complicating factor. In a few of the cases reported as congenital it is noteworthy that the patients, though adults, gave only a recent history of gastric disturbance.

On the other hand, the physical signs of the condition have been given considerable stress. Moynihan (14) holds that these signs, in conjunction with the symptoms, enable a positive diagnosis to be made in the great majority of cases. Mayo Robson (13) says: "While in nearly all cases the cause has been capable of diagnosis, the effect has also been diagnosed in some, and may be in nearly all cases if care and time be given the diagnosis."

Tuffier (20) states that the importance of the clinical signs has diminished with the use of the roentgen ray. However, he sounds a warning to the effect that in spite of its precision a roentgenologic examination for hour-glass stomach may lead to error.

Moynihan's compilation of the physical signs, as quoted by Osler (15), includes the following:

1. A measured quantity of water is put into the stomach through the tube. The water is immediately withdrawn but a portion fails to return, having been lost as through a hole. (Woelfler's first sign.)

2. The stomach is washed out until the fluid returns clear. There may then be a sudden rush of foul smelling liquid, regurgitated from the lower pouch. (Woelfler's second sign.)

3. The stomach is filled with fluid, and succussion sounds are elicited. After withdrawing the fluid as completely as possible, succussion sounds may still be noted because of liquid still remaining in the lower loculus. (Jaworski's paradoxical dilatation.)

4. Von Eiselsberg observed in one of his cases that on distending the stomach a bulging of the left side of the epigastrium was produced; after a few moments this gradually subsided and at the same time there was a gradual filling up and bulging of the right side.

5. Von Eiselsberg has also noted a hissing sound in the region of the constriction, while distending it with CO_2 by administering separately the two component parts of a seidlitz powder. The noise is heard by applying a stethoscope two or three inches to the left of the midline.

6. By using a seidlitz powder in the same way, Moynihan has noted after 20 or 30 seconds an enormous increase in resonance of the upper stomach. Later, the pyloric pouch may fill and become prominent.

7. Schmidt-Monard, Eichhorst, and Moynihan have all seen cases which showed a distinct sulcus between the two pouches after distention with CO_2.

8. By filling the stomach with water and employing gastrodiaphany, Ewald (6) has observed that the transillumination is seen only in the cardiac pouch lying to the left of the midline, while the pyloric pouch remains dark. He has also used the deglutable rubber bag of Hemmeter (8) and Turck (21) in a similar way; distending the bag causes a bulging of the cardiac pouch only.

While some of these signs carry more or less conviction, there are some which seem almost trivial. Notwithstanding the opinion of Mayo Robson and Moynihan that a positive diagnosis is possible in most cases, it is noteworthy that neither they nor others report many cases as having been diagnosed clinically before operation, while it is obvious that the roentgen ray affords a practical and efficient means of diagnosis.

ROENTGEN DIAGNOSIS

Since the essential feature of an hour-glass stomach is its biloculation by an intermediate constriction, it would seem that the choice of roentgenologic methods to demonstrate this fact is not important. It is conceivable that the roentgen examination might show the biloculation after air inflation more or less positively. However, by filling the stomach with an opaque meal, the deformity of the gastric outline is shown more definitely, and this method is almost universal (Fig. 8).

The screen examination is made with the patient standing and, if necessary, in the recumbent position also. Plates may be made with the patient in either position, but in hour-glass stomach the vertical is preferable.

Hour-glass deformity is so striking in the roentgen shadow of the barium-filled stomach that, save in exceptional instances, it can readily be recognized even by the novice. But, as Groedel (7) well says, the diagnostic task has only begun with the establishment of the presence of an hour-glass form for the roentgenologist should endeavor to distinguish between the following varieties: (1) organic; (2) spasmodic, from an intrinsic lesion; (3) spasmodic, from lesions or conditions outside the stomach; (4) pseudo hour-glass.

In conformity with its pathologic anatomy the organic hour-glass resulting from gastric ulcer usually shows a B-form (Fig. 9) in the roentgen image, the constriction being at the expense of the greater curvature, which is drawn toward the lesser. Almost invariably the cleft is deep and relatively narrow, so that the loculi communicate by a short canal of small caliber. Indeed, the canal may be so stenotic that a portion of the six-hour meal is retained in the upper loculus, but this is exceptional. However, with a very narrow channel the stenosis may be evident by retarded passage of the barium water or barium pap during the screen examination, even if there is no retention from the six-hour meal, and in many cases it trickles very slowly through the aperture, running in a curvilinear course along the lesser curvature.

With these conditions present, the observer can feel considerable certainty that the hour-glass is really organic. Cerné and Delaforge (2) have called attention to another item of some diagnostic significance: the sagging of the upper loculus (Fig. 10). They describe the lower border as curved and encroaching upon the cleft, or else completely overhanging it, so that palpatory pressure may be necessary to demonstrate the constriction between the loculi. Often a niche, or accessory pocket, is seen on the lesser curvature side of the isthmus associated with hour-glass, and this favors the probability that the hour-glass is organic, although it is not conclusive proof. Fixation of the stomach, as evidenced by its resistance to efforts at palpatory shifting, also suggests that the deformity is organic. An important feature is the fact that neither the position nor the contour of the constriction can be altered by manipulatory massage.

Carcinomatous organic hour-glass is easily recognized, as a rule. The isthmus may be centrally placed, often with a funnel-like expansion at either end, so that it has the form of a script-X (Fig. 11). The contour of the canal is usually irregular, due to small projections from the tumor mass, and the dim shadows of the growth itself may be visible. If, in addition, a tumor corresponding to the filling defect can be felt, the evidence is reasonably complete. However, all the cases do not possess these typical characteristics; the growth may involve only one curvature, and in such instances the channel between the loculi lies along the opposite curvature. In many of the cases the condition is, strictly speaking, an hour-glass form of the gastric lumen rather than of the stomach as a whole, the local narrowing of the cavity being caused by the projection of the tumor into the lumen, and judging by the external contour of the stomach, as seen at operation, the surgeon would hardly consider it a true hour-glass. Medullary cancer especially may produce an hour-glass of this sort.

The scirrhous type, infiltrating the gastric wall, is more likely to result in actual contraction. It is interesting to note that the carcinomatous hour-glass seldom causes a six-hour retention in the upper loculus, even though the isthmus is quite narrow.

Syphilitic hour-glass may result either from luetic ulceration or hyperplasia. The hyperplastic or gummatous type with filling defects and a corresponding palpable mass is not roentgenologically distinguishable from cancer. Syphilitic ulcers are often multiple, and their strong tendency to the production of hour-glass has been frequently noted (Fig. 12). Dewis (3) believes that he has noted a characteristic point which differentiates it from cancer and simple ulcer: "In syphilitic hour-glass of the stomach we see a long, regular isthmus, at each end of which the walls of the stomach rise more or less abruptly or dumb-bell-like. This is in contrast to the sharp incision of simple ulcer hour-glass with practically no isthmus, and the picture differs quite as much from the cancer hour-glass with the infiltrated walls of the stomach sloping irregularly away from the constricted portion." (Fig. 13.) This dumb-bell appearance has also been described by LeWald (12). We have occasionally observed the appearance which Dewis and LeWald describe and sometimes fancied that the shadow of the barium-filled luetic stomach showed a peculiar "flatness" as compared with the roentgenograms of other lesions. As a matter of fact, however, the roentgenologist's first suspicion of the lesion being syphilis rather than cancer is usually aroused not by the roentgen picture so much as by certain obvious clinical facts. There is the absence of a palpable mass, the patient may be under the cancer age, he is anæmic rather than cachectic, and has not lost weight and strength in proportion to the extent of gastric involvement and the duration of his trouble. Then, with a positive Wassermann, the diagnosis of lues is warranted, but hardly otherwise.

All forms of organic hour-glass stomach have certain features in common: they are persistent at successive examinations, constant in situation, cannot be effaced by epigastric massage, and remain unaltered after the patient has been given atropine or belladonna to physiologic effect.

Purely spastic forms of hour-glass, produced

directly by gastric lesions and hence conveniently designated as "intrinsic," are seen in association with ulcer and cancer. As stated before, the spastic hour-glass of ulcer, like the organic form, is seen opposite the ulcer in the shape of an indentation of the curvature, usually the greater (Fig. 14). The depth of the indentation varies, but is nearly always greater than its width. Occasionally, when the indrawing is not very pronounced, it may appear as a triangular notch. Each of two or more ulcers may produce an incisure either separately or, if the ulcers are closely adjacent, fused irregularly together so that the margins are not clean-cut. As a rule, the single, deep, spastic incisure is regular in outline, with straight, parallel sides, and this appearance is of some value in distinguishing it from an organic constriction. However, such characteristics have also been observed in organic hour-glass stomach (Figs. 8 and 9). In other respects it does not differ from the organic variety, is constant in situation, present at a second examination, can not be obliterated by palpatory maneuvers and is still present after the administration of antispasmodics.

Spastic contraction is associated with gastric cancer less frequently than with gastric ulcer. Usually it is seen as an indrawing of the greater curvature opposite the growth and is considerably wider than the contraction produced by an ulcer. Holzknecht has spoken of it as the "broad incisura" of cancer (Fig. 15). The luminal margin of the contraction is often irregular. Rarely a small cancer may provoke a narrow spastic contraction, resembling that of ulcer. The broad spasmodic contraction may be mistaken for a filling defect produced by the growth itself, but close inspection of the plate will show that the indentation is clearly outlined without any faint shadow of a tumor mass between the borders, although a shaded filling defect corresponding to a palpable mass may be seen directly opposite the contraction. The whole picture is, as a rule, so plainly indicative of cancer that the examiner will have little interest in the question whether the hour-glass is organic or spasmodic, or both. That spasm probably accentuates the various forms of organic hour-glass deformity is supported by the fact that the isthmus depicted by the roentgen ray is often much narrower than when exposed to view at operation.

Spasmodic hour-glass contraction resulting from, or at all events, associated with, conditions outside the stomach is one of the most deceptive manifestations with which the roentgenologist has to deal (Fig. 16). Although a definite etiologic relationship is difficult to establish, there are three conditions which are especially prone to be accompanied by some form of gastrospasm, namely, chronic cholecystitis, chronic appendicitis and duodenal ulcer. Gastric spasm is not infrequently seen in morphinism, plumbism, general nervous states or in timid patients who are frightened by the process of examination. With some of these spastic phenomena, such as "total gastrospasm" for example, in which the entire stomach is irregularly contracted, we are not here concerned. Local or regional extrinsic spasms producing hour-glass deformity are most frequently seen as a cleft of the greater curvature, resembling the incisura of a gastric ulcer. With one exception, spastic hour-glass from extrinsic causes can usually be differentiated from other forms of hour-glass. Extrinsic spasm may alter in intensity and thus change in appearance during the examination; it can sometimes be erased by steady, forceful, though not violent epigastric massage; it is often absent at a second examination; it disappears after giving belladonna (Fig. 17).

The one exception to these eliminative tests is gastric spasm arising from duodenal ulcer. The spasm ranges from a moderate incisure to a pronounced contraction and tends to persist even after full doses of belladonna have been given, so that the observer is inclined to accredit it to a gastric lesion (Fig. 18). The puzzle is further complicated by the fact that a duodenal ulcer and a gastric ulcer may occur in the same case. In every instance of suspected spastic hour-glass, it behooves the examiner to confirm or exclude the presence of duodenal ulcer. If an ulcer is present, as shown by constant distortion of

the duodenal bulb, the presumption is strong that it is the cause of the gastrospasm, although careful search should be made for the niche of a gastric ulcer. If no duodenal ulcer is found and the gastrospasm withstands all eliminative tests, the spastic condition is probably of intrinsic origin, thus indicating a lesion within the stomach, even though it cannot be seen (Fig. 19).

In administering belladonna to relax gastrospasm it is emphatically necessary that the amount given is sufficient to produce the usual physiologic effects of dryness of the throat, pupillary dilatation, etc. Our own custom is to prescribe the tincture, starting with twenty drops and repeating the dose frequently, until the desired effect is obtained. Since some patients have an idiosyncrasy for the drug, it is advisable to keep them under close observation and stop its administration, if untoward symptoms develop.

Atropine sulphate, injected hypodermatically in single doses of 1/100 to 1/50 of a grain, is preferred by some examiners. It has the advantage of permitting a second examination soon after the first, probably before the stomach is empty. We have not adopted this practice, because it is impossible to determine the necessary dose to produce a physiologic effect, and patients usually object to repeated hypodermic injections. On the other hand, belladonna can be given by mouth without any objection from the patients and, so far as our experience goes, the results are all that could be desired.

Conflicting opinions as to the effectiveness of belladonna in abating gastrospasm are probably due to the various forms, methods, and doses, in which it is given. Thus, Reizenstein and Frei (17) state: "We must reject the accepted teaching that atropine will differentiate the spastic from the organic forms. We could never convince ourselves of a positive effect of atropine in the sense of relaxing spasm but, on the contrary, have observed an increase of it by this means." Barclay (1) says that belladonna relaxes some spasmodic hour-glass stomachs, while it may have no effect on others that are susceptible to the effects of massage and thus prove themselves to be spasmodic. He also cites a case in which the stomach was relaxed by belladonna, and yet a healed ulcer was found at operation. Rieder (18) who uses the extract of belladonna, states that only a positive result is of value. Strauss (19) has found both atropine and papaverine very unreliable in his experience. Notwithstanding the testimony of these observers, our own cases of extrinsic hour-glass stomach (barring those produced by duodenal ulcer) which failed to relax after belladonna were only those in which an insufficient amount of the drug had been given, and our own confidence in this test remains unshaken.

It is true that belladonna or atropine will not differentiate between spasmodic and organic forms of hour-glass stomachs, but they will differentiate between the intrinsic and extrinsic forms. When the hour-glass contraction is the only roentgen sign present, this test must be very carefully carried out, as otherwise the roentgenologist may lead the surgeon into error. It has been our experience that any hour-glass that resists belladonna to the physiologic effect means a lesion either of the stomach or duodenum; and regardless of whether the hour-glass is present or not at operation, the surgeon will find the cause, if he looks for it.

Barclay's case of healed ulcer with relaxation of the hour-glass after belladonna is extremely interesting. We have never observed such a case. Neither have we found massage to have any effect on intrinsic gastrospasm. At the same time, the obvious fact should never be overlooked that all spasmodic forms of hour-glass stomach are relaxed by the anæsthetic.

Aside from the hour-glass deformities of the stomach due to actual contraction of the gastric walls, whether organic or spastic, there are pseudo hour-glass forms, i. e., certain semblances of the hour-glass form, as seen roentgenologically, which may be more or less deceptive to the untrained observer.

One of these is the elongated, hypotonic, or so-called atonic stomach. Hertz (10) dignifies it by the term "orthostatic" hour-glass stomach. By reason of its tonusless walls, the stomach is lengthened and its capacity increased. Ingesta which would fill

Fig. 1.

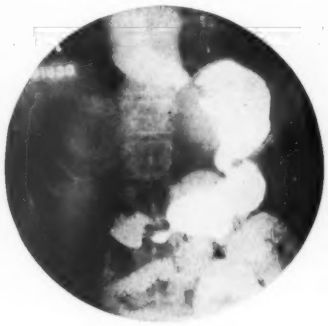

Fig. 2.

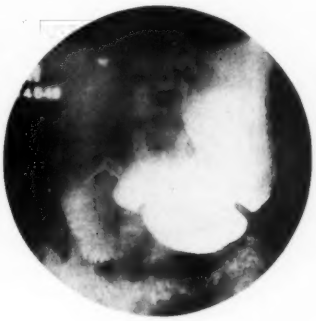

Fig. 3.

Fig. 1 (152198). Organic hour-glass stomach in a case of gastric tuberculosis. Postmortem confirmation.

Fig. 2 (191830). Spasmodic hour-glass stomach after gastrostomy, done 18 years ago in a case of cardiospasm.

Fig. 3 (94543). Spasmodic hour-glass constriction following sleeve-resection for multiple gastric ulcers. Contracture at point of anastomosis.

a stomach of average size accumulate in the expanded basin-like lower pole and, with the patient standing, the dragging weight of the gastric contents causes a spindle-like approximation of the walls in the middle third. The ingesta can be forced upward by manual pressure, so as to dilate the apparent narrowing and thus prove its deception.

Somewhat similar in appearance, and perhaps related to the above, is the so-called corset-stomach, seen in enteroptotic women who are given to tight lacing. However Groedel believes that the corset-stomach belongs to the scar hour-glass type and says: "It is anatomically confirmed that foolish tight lacing may give rise to a thickening of the serosa which shows the characteristics of a scar hour-glass." Rieder (18) also lists it as a possibility among the acquired forms but considers it doubtful and very improbable that tight lacing would cause a permanent hour-glass.

A third simulant of hour-glass is that produced by the imprint of a tumor outside the stomach. The indented portion of the gastric wall is usually a wide, smooth incurva-

Fig. 4.

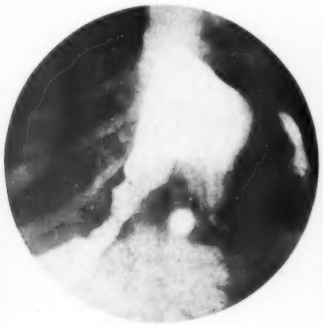

Fig. 5.

Fig. 6.

Fig. 4 (191809). Spasmodic hour-glass constriction following sleeve-resection. The narrowing is at the point of anastomosis.

Fig. 5 (212801). Hour-glass stomach due to adhesions, in a case of cholelithiasis and chronic appendicitis. Stomach and duodenum negative. Roentgenogram made after deep inspiration.

Fig. 6 (179078). Intrinsic hour-glass stomach. Case of gastric ulcer without crater formation. Contracture appears much deeper in roentgenogram than it did at operation.

Fig. 7.

Fig. 7 (142921). Intrinsic spasmodic hour-glass stomach in a case of colloid carcinoma on posterior stomach wall. The deformity was not affected by belladonna, and it was not found present at the time of operation.

Fig. 8.

Fig. 8 (143766). Perforating gastric ulcer producing organic hour-glass stomach.

Fig. 9.

Fig. 9 (157751). Organic hour-glass stomach in a case of gastric ulcer. The deformity gives the stomach the form of a capital letter B.

tion which changes appearance on manipulating the stomach.

Other causes of pseudo hour-glass stomach are, for example, strong retraction of the abdominal wall, and the dorsal and prone position of the patient (Fig. 20). Most of these simulants can be easily eliminated by a little manual palpation behind the screen, especially while in the vertical position (Fig. 21).

Practically, then, unless the case is extraordinarily typical, it is only by a process of elimination that the several varieties of hour-glass stomach can be differentiated. First, the mere pseudo hour-glass must be excluded, and this is seldom difficult; next, extrinsic spasm from most causes can be eliminated by the various procedures mentioned, particularly the belladonna test. If the hour-glass persists after this test, the examiner may reasonably assume that the deformity is either (1) organic of itself, (2) that it is an intrinsic spasm arising directly from a gastric lesion, or that it is (3) an extrinsic spasm due probably to duodenal ulcer.

Fig. 10.

Fig. 10 (23008). Organic hour-glass stomach, in a case of perforating ulcer of the stomach.

Fig. 11.

Fig. 11 (172006). Concentric ( )( ) type of hour-glass stomach in a case of gastric cancer.

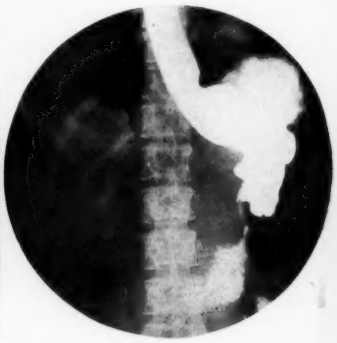

Fig. 12.

Fig. 12 (173711). High organic hour-glass stomach in a case of gastric syphilis. The Wassermann test was positive.

Fig. 13.

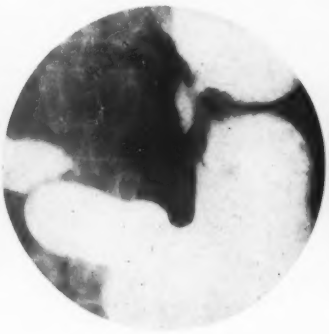

Fig. 14.

Fig. 15.

Fig. 13 (218041). High hour-glass stomach with dilatation of the œsophagus in a case of gastric lues. Wassermann positive.

In spite of sounding (25F) and antiluetic treatment the constriction became more marked. The patient lost weight rapidly, from 113 to 79 pounds. Fluids were taken with great difficulty and operation was thought advisable.

Findings at operation: Stomach about 10 centimeters long and from 6 to 7 centimeters in diameter. For a distance of 4 centimeters extending from the pylorus up to the constriction the stomach was contracted to about 1 centimeter in diameter.

Operation: Sleeve-resection, with removal of two-thirds of the stomach. Jejunostomy.

Fig. 14 (146382). Perforating gastric ulcer. Spasmodic hour-glass stomach. Not affected by belladonna because intrinsic in cause and not present at operation because relaxed by the narcosis.

Fig. 15 (140035). Intrinsic spasmodic hour-glass stomach. Malignant ulcer of the posterior wall of the stomach.

A careful screen and plate examination of the duodenal bulb will either confirm or exclude the presence of an ulcer. If no duodenal ulcer is present, the presumption is strong that the constriction of the stomach is due to a gastric lesion, with the chances favoring ulcer or its scar, even though the niche of the ulcer cannot be seen. If a duodenal ulcer is found, it may be inferred that the hour-glass is a spastic reflex from the ulcer, although this inference is not absolutely safe, since about 11.5 per cent of duodenal ulcers occur in association with gastric ulcer. When the field has been logically narrowed to a choice between an hour-glass deformity which is organic of itself and one which is

Fig. 16.

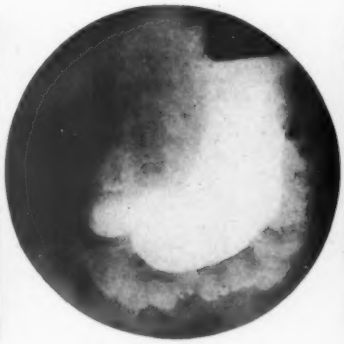

Fig. 17.

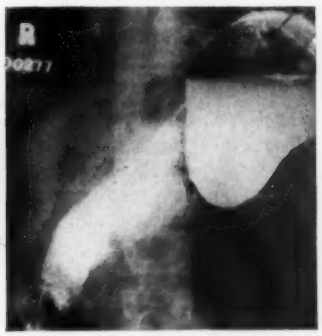

Fig. 18.

Fig. 16 (20594). Extrinsic spasmodic hour-glass stomach which relaxed after belladonna to physiologic effect. Note Fig. 17.

Fig. 17 (20594). Same case as Fig. 16. Stomach normal in outline after giving belladonna to the physiologic effect.

Fig. 18 (100277). Spasmodic hour-glass stomach in a case of duodenal ulcer. The hour-glass was not present at operation because it was relaxed by the anæsthesia. Such spasms are not relaxed by antispasmodics in our experience.

Fig. 19.

Fig. 19 (150426). Spasmodic hour-glass stomach in a case of duodenal ulcer. This is the only type of hour-glass having an extrinsic cause not relaxed by belladonna to physiologic effect.

Fig. 20.

Fig. 20 (111020). Pseudo hour-glass stomach due to strong retraction of the muscles of the abdominal wall.

Fig. 21.

Fig. 21 (147151). Pseudo hour-glass stomach due to pressure of stomach against the spine.

spastic but arising from a gastric lesion, the examiner is apt to concern himself more with the nature of the cause than the manner in which the hour-glass effect is produced. In other words, he is more interested, and properly so, in deciding between ulcer, cancer, and syphilis, than in determining whether the hour-glass is due to intrinsic spasm or to permanent contraction. If the upper loculus shows a retention from the six-hour meal, or if the upper loculus sags to the left and below the cleft, or if there are irregular filling defects about the isthmus typical of cancer, the examiner may be quite confident that the constriction is at least partly organic and will be found by the surgeon. But if with a tight hour-glass constriction there is neither a retention from the six-hour meal, nor a retarded flow of the barium suspension, if no niche, accessory pocket, or filling defect is visible, and the indentation has straight, parallel borders, the contraction is probably spastic and will not be seen by the surgeon at operation.

CONCLUSIONS

1. Hour-glass stomach should not be considered a disease entity but an end-result of various pathologic processes, gastric and perigastric.

2. The possibility of congenital hour-glass stomach must be admitted, although most cases reported have been questioned.

3. The roentgenogram usually shows a much deeper constriction than is seen at operation, due to the fact that the organic narrowing is exaggerated by the spasm.

4. Cases of spasmodic hour-glass, whether intrinsic or extrinsic in cause, are not seen by the surgeon, because they are relaxed by the narcosis. Therefore, if the hour-glass is the only roentgen sign present, the first thing to do is to exclude extrinsic causes.

5. Belladonna or atropine does not differentiate between the organic and intrinsic types of spasmodic hour-glass stomach.

6. Belladonna or atropine to physiologic effect will differentiate between the intrinsic and extrinsic types of spasmodic hour-glass stomach.

7. Operations have proved the organic type the most common. However, the spasmodic, when intrinsic in origin, is just as important from a diagnostic standpoint, as the organic.

8. The varieties of hour-glass stomach, therefore, admit of the following subdivision:

A. Congenital.

B. Acquired.

1. Organic; constriction due to structural changes in or about the stomach. Causes: ulcer, scar of healed ulcer, perigastric adhesions, cancer, syphilis, corrosives, resection, gastrostomy, congenital (?).

2. Spasmodic (or functional); cramp of the gastric muscle without structural change. Two types: (a) intrinsic; cramp directly produced by lesions in the stomach; causes practically the same as those of organic hour-glass; (b) extrinsic; cramp indirectly produced by causes outside the stomach: duodenal ulcer, diseases of the gall-bladder, disease of the appendix, neuroses, tabes, lead intoxication, morphine, nicotine.

C. Pseudo hour-glass; simulating the hour-glass form without either spasm or structural change in the stomach. Causes: contraction of abdominal muscles, pressure of stomach against the spine, tumors outside the stomach, atonic stomach, gas and fæcal matter in the bowel.

REFERENCES

1. Barclay, A. E. The Alimentary Tract. New York: Macmillan, 1915, p. 73.
2. Cerné and Delaforge. La radioscopie de l'estomac pathologique; dilatations et ptoses. Normandie méd., 1908, xxiii, 57-65.
3. Dewis, J. W. Aids in the diagnosis of surgical conditions of the stomach, with special reference to the characteristic X-ray appearance of the syphilitic hour-glass stomach in contrast to those of simple ulcer and cancer. Canad. M. Ass. J., 1915, v, 1056-1069.
4. Elder, J. M. The acute abdomen. Canad. M. Ass. J., 1915, v, 85-92.
5. Eusterman, G. B. Hour-glass stomach and duodenum. J. Mich. St. M. Soc., 1914, xiii, 417-422.
6. Ewald, C. A. Zur Diagnostik des Sanduhrmagens. Deutsche Arch. f. klin. Med., 1902, lxxiii, 152-161.
7. Groedel, F. M. Grundriss und Atlas der Roentgendiagnostik in der inneren Medizin. Munich: Lehmann, 1914, p. 357.
8. Hemmeter, J. C. An apparatus for obtaining records of the motor functions of the human and animal stomach on the kymographion. N. Y. M. J., 1895, lxi, 769-772.
9. Hermes, O. Magenvolvulus bei Sanduhrmagen. Deutsche Ztschr. f. Chir., 1908, xcv, 310–319.
10. Hertz, A. F. Functional hour-glass stomach. Proc. Roy. Soc. Med., Med. Sec., 1911-1912, v, 60-72.
11. Klein, quoted by Watson, F. S. Hour-glass stomach and its surgical treatment. Ann. Surg., Phila., 1900, xxxii, 56-95.
12. LeWald, L. T. Syphilis of the stomach. Further studies, based on nineteen cases. Am. J. Roentgenol., iv, 76-80.
13. Mayo Robson, A. W. On hour-glass stomach from a personal experience of 23 operations. Lancet, Lond., 1904, i, 5-9.
14. Moynihan, B. G. A. Hour-glass stomach. Brit. M. J., 1904, i, 413-416.
15. Osler, W. Principles and Practice of Medicine; New York: Appleton, 1917, p. 495.
16. Reinecke. Volvulus des Pylorusteiles eines Sanduhrmagens. Deutsche Ztschr. f. Chir., 1913, cxix, 149-169.
17. Reizenstein, A., and Frei, F. Roentgenologisches und Klinisches zur Frage des Sanduhrmagens. Arch. f. Verdauungskr., 1914, xx, 94-121.
18. Rieder, H. Die Sanduhrformen des menschlichen Magens. Wiesbaden: Bergmann, 1910, p. 74.
19. Strauss, H. Klinisches und Kritisches ueber den Sanduhrmagen. Arch. f. Verdauungskr., 1915, xxi, 89-93.
20. Tuffier, T., and Roux-Berger, J. L. L'Estomac biloculaire. Presse méd., Par., 1913, xxi, 369-372.
21. Turck, F. B. A double stomach tube. J. Am. M. Ass., 1896, xxvi, 79-80.

PULMONARY ŒDEMA DURING PREGNANCY

Two Unusual Cases

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PULMONARY œdema as a terminal complication in cases of eclampsia is a well-known phenomenon. The occurrence, however, of a sudden, rapidly fatal pulmonary œdema occurring without convulsions or coma is apparently somewhat rare. The standard textbooks, indeed, make no mention of it. Berkley and Bonnie mention that œdema of the lungs is to be feared in cases of chronic heart disease and they also state that it, or pneumonia, may supervene during the eclamptic state, when it points to a fatal termination. They make no reference to the type of case which we wish to report. Williams, Eden, or De Lee make no mention of the condition. In a fairly complete search of the literature of the last fifteen years we can find only one reference to this clinical picture. Pouliot, in *The Annals of Gynæcology and Pediatry* for October, 1905, has an article entitled "Œdema of the Lungs Complicating Pregnancy," in which he says that it is one of the serious complications of pregnant women with cardiac lesions. He states that the attacks may come during comparatively good health but that the symptoms reach a crisis only after the efforts of delivery. In his words, "the condition is due to the hypertension of the lesser circulation resulting from a very narrow mitral stenosis," but he points out that it is also probable that the pulmonary œdema may be a manifestation of the toxæmia of pregnancy. He realized that the attacks might occur before labor for he warns against the induction of premature labor during an attack.

In the Public Ward cases of the Toronto General Hospital, although we have had cases of œdema of the lungs as a terminal catastrophe of eclampsia, there has been no instance of acute primary œdema. The two cases we wish to report are both private ones but were each seen by the two of us.

Case 1. Patient of Doctor Scott. Mrs. M. C., a primipara, age 42, presented herself on February 26, 1916. The last menstruation had been Oct. 4, 1915, previous to which menstruation had been regular. Her past history was negative except for the fact that she had had typhoid fever six years previously from which she made a good recovery. Her pelvic measurements were normal and the systolic blood pressure was 140. She was having some considerable daily nausea but little vomiting and she had not yet felt life. There was no albumin in the urine and no casts were seen microscopically. The urine was examined every two weeks and the patient told to present herself once a month for examination. On March 29, 1916, the urine contained no albumin, the systolic blood pressure was 142 and the patient was feeling well. On April 10, 1916, the urine was found to contain a large amount of albumin, going almost solid on boiling. She was seen at once and her systolic pressure was then 240. The patient claimed to be feeling in the best of health and was much chagrined when told that instead of going to the theatre that evening she had to go to the hospital. She confessed to having had some slight headache for two days to which she paid no attention. There were no eye symptoms and no epigastric pain, but some slight swelling of the feet and ankles was found to be present though there was none of the face. Shortly after taking her blood pressure she developed pain under the angle of the right scapula. Much against her will she was sent to the hospital at once where she arrived at 6.45 p.m. One-quarter grain of morphia was given, the usual eliminative treatment started and when seen at 8.30 she carried on a quite rational conversation, claiming to be feeling quite well in every respect. Just before coming to the hospital she had vomited once and at 11.30 she vomited some frothy, bloody fluid. At 2.00 a.m. Scott was called by the house surgeon who said he thought the patient had developed a pneumonia. She was quite conscious but in great distress, suffering from extreme dyspnœa and was deeply cyanosed with both sides of her chest full of bubbling râles. Bloody fluid was running from her nose and mouth and there was dullness both in

front and behind to the level of the clavicles. The systolic pressure at this time had dropped to 160. The basilic vein was opened in an attempt to bleed her but only a small amount of thick, almost black blood, could be obtained. She was given oxygen subcutaneously and was stimulated in every way possible but died in an hour without having had a convulsion and remaining semiconscious to the end. No autopsy could be obtained.

CASE 2. Patient of Doctor McIlwraith, Mrs. P., age 35, II-para. The first pregnancy had ended in an early abortion. There was no history of previous illness except that she had had some attacks of faintness years before which had been attributed to heart disease. Careful examination, however, revealed no demonstrable lesion. The last menstruation had occurred on March 13, 1916. The patient lived in another city and a month before coming to Toronto had sent a sample of urine which was examined and found to be normal. She omitted to send a sample two weeks later and during this time did not feel in her usual good health. She came to Toronto on November 19, 1916, and was then found to have a systolic blood pressure of 210 and a slight amount of œdema of the feet. She was sent to the hospital at once. The urine had a specific gravity of 1010, was acid in reaction and contained a considerable amount of albumin with granular casts and large numbers of bacilli. She was put to bed and given magnesii sulphas and 15 minims of veratrone. At 3.30 that afternoon her temperature was 99.3° and her pulse 104. At 7.30 p.m. the patient was sitting up in bed feeling perfectly well and chatting with her husband, but fifteen minutes later was seized with sudden coughing, dyspnœa, and choking. When McIlwraith arrived fifteen minutes later her distress was extreme. Large bubbling râles could be heard on both sides of the chest and though quite conscious and rational the patient was very cyanotic. A venesection was done and 16 ounces of free flowing blood removed after which she was given one-quarter grain of morphia and five grains of camphor in oil. At eleven p.m. it was proposed to do a cæsarean section but a skilled anæsthetist refused to give the patient an anæsthetic. Therefore the membranes were ruptured and one-eighth grain of morphine given after which she was allowed to breathe oxygen. Her condition improved at once and, though she vomited large quantities of clear fluid during the night, she suffered little distress. By the following noon, however, she was again suffering from extreme dyspnœa with blood-stained, frothy mucus running from her nose and mouth. At 3.30 p.m. a cæsarean section was done under gas and oxygen and local anæsthesia. She was delivered of a living child but her condition did not improve and she died at 2 a.m. Nov. 24, 1916.

We have here, then, two cases of acute pulmonary œdema occurring during pregnancy, one at six months and the other at eight months. In both cases the outstanding feature was a tremendously high blood pressure. In the first case, apart from the urinary findings, there was very little else to be discovered before the onset of the acute symptoms. The second case, it is true, had a considerable amount of œdema elsewhere in the body, but in the first case this œdema was confined to the lungs. In neither case, so far as could be discovered, was there any pre-existing cardiac lesion. These cases can hardly be classed as eclamptic because they had no convulsions (which we consider essential for eclampsia), nor did they die in coma without convulsions, which of course, by some observers, is enough to classify a case as eclamptic. We interpret the condition as being due to a profound toxæmia giving rise to a high blood pressure which finds its outlet in a spot of weakened resistance in the lung. These cases have strengthened a conviction which we have held for some time; namely, that blood pressure findings are the best indications that we have regarding the severity of a given case of pre-eclamptic toxæmia. Moreover, in dealing with albuminuria and high blood pressure during pregnancy one should have in mind not only the possibility of a development of convulsions but also that at any time a complication far more tragic than the ordinary eclampsia may arise.

DEPARTMENT OF TECHNIQUE

TEMPORARY INTERNAL FIXATION OF COMPOUND FRACTURES

By W. L. BROWN, M.D., F.A.C.S., and C. P. BROWN, M.D., El Paso, Texas

As our work has increased in bone surgery, we have come to realize more and more the importance of making some improvement on the usual methods of immobilizing compound fractures. As we have occasion to operate more often on ununited fractures, with deformity, overriding and fragmentation, the more firm has become our belief that it is better and much easier to prevent these deformities than to correct them, after they have occurred. It is not unusual to find cases of the ulna and radius having united in bad position with considerable functional impairment, where at operation it is almost impossible to correct the deformity without taking the risk of resection and bone transplantation.

From experimental, as well as clinical work, we now know that the first effort nature makes in the repair of a fracture, is always her greatest. Consequently, it is essential to give her every aid during the first effort, instead of assuming that it will be an easy matter to correct a deformity, do a transplant, and get a good functional result at a secondary operation. The more experience we have in fractures, expecially since the advent of the X-ray and frequent operations, the less confidence we have in our ability to reduce fractures and maintain them in reduction by external manipulation and external splinting.

The general trend in the treatment of compound fractures during the present war is toward much more radicalism than formerly practiced. This is only in keeping with sound surgical principles. While we do not advocate operating upon every compound long distance bullet fracture, still, we have never had occasion to regret having done so. Our attitude toward so-called conservative treatment, or no treatment of compound fractures, except disinfection of the skin, is very much like our attitude toward waiting after a diagnosis of appendicitis, or not giving antitoxin after a diagnosis of diphtheria, because we can point to a certain percentage of cases, even 90 per cent, that have recovered without operation or antitoxin.

We think there has been no more pernicious teaching than that of so-called conservative treatment, until infection is well established. This has been recommended in some very recent articles on fractures, by surgeons otherwise considered good authorities.

In the treatment of gunshot fractures, those of the most experience in the present war, quite uniformly agree that immediate operative interference, with removal of foreign bodies, cutting away of devitalized tissue, establishing free drainage, thorough cleansing with some antiseptic and as complete immobilization as possible, are the important indications. Some are now beginning to think that complete mechanical cleansing, cutting away of devitalized tissue, drainage and external immobilization as complete as possible, are probably sufficient without the use of antiseptics. There is being more and more stress laid upon the mechanical cleansing and immobilization than any other two features of the treatment.

Our experience for the past two years has added what we believe to be something as important as either of the above two or possibly more important, and that is temporary fixation of the fracture, preferably with the Parham-Martin band, or if not feasible, with a Lane's plate; this fixation to be removed under local anæsthesia as a rule at the end of five or six weeks. In cases of compound fractures where interference is otherwise indicated for the control of hæmorrhage, removal of foreign bodies, disinfection or coaption of fragments, we have found nothing to contraindicate the use of internal fixation with the express idea of removing it as soon as there has been sufficient callus and fibrous tissue formed to hold the fragments in apposition. We are unable to see any comparison between this method, where the above procedures are otherwise found necessary, and that of transfixation by methods where screws or pegs are driven into bones for the purpose of making extension. The internal fixation frequently reduces or solves the problem of extension.

Fig. 1 (at left). Belt wheel accident: compound fracture, both bones of leg, with extensive laceration soft tissues. Immediate plating and Dakin's solution. Plate removed six weeks. Firm union, five months.

Fig. 2. Same as Fig. 1, 7 months following injury. Alignment perfect with large, bony calluses, both bones.

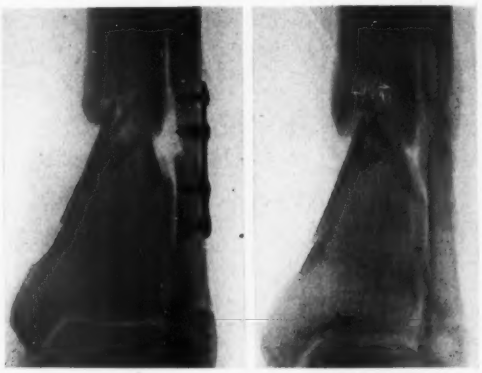


Fig. 3 (at left). Two months after operation, car wheel injury, extensive destruction of soft parts and tibia. Two fractures of fibula. Too much destruction of tibia to allow plating. Plating of fibula and Dakin's solution at primary dressing. Small sinus at eight weeks when plate was removed.

Fig. 4. Three months 14 days following operation; all wounds healed, firm union in both bones. Leg perfectly straight, good motion ankle-joint. Able to resume work at the end of 5 months.

It was the teaching of the late John B. Murphy never to bury any foreign substance at the primary dressing of compound fractures, because they never healed while a foreign body was present. While this teaching we believe was correct, still Murphy had in mind the question of buried material being left permanently and we never heard anything in his teachings or read anything in his writings where he approached the question from any other standpoint. It is also agreed by those most experienced in the present war, that the extension of infection in compound fractures bears quite a definite ratio to the degree of immobilization.

After all of the above procedures have been carried out, we consider next of importance, the proper placing of drainage tubes, as advocated by the followers of the Carrel-Dakin method of wound disinfection and just as close attention should be paid to these details in the cases that have internal fixation, as in other cases. That the application of the Carrel-Dakin method has been misapplied and misunderstood from a mechanical standpoint, as frequently as from the improper preparation of the solution, we are quite well convinced. We have repeatedly seen it applied in a way that it was simply traversing a through-and-through drainage tube and not in any way coming in contact with the deeper parts of the wound.

It may be argued that in introducing a metallic foreign body into a compound fracture, we are putting in the exact thing which we have set out to remove. While it may so appear, this is not true, because the original foreign body is probably infected, it goes into the soft tissues and is a focus of danger and is often buried deeply where there is improper drainage. On the other hand, the internal fixation foreign body has none of the above objectionable features and is always at a point where drainage is best and antiseptics are present.

One of the immediate effects noticed, following internal fixation of the fragments, is the relief from pain. This and the convenience of handling the limb for frequent dressings, are alone worth many times the discomfort of a minor operation for its removal. The plate or band is never covered by bone sufficiently to require a chisel or bone forceps for its removal at the end of six weeks. We have had this experience in removing plates or bands where they have been in three months or longer, and we do not believe they interfere with regeneration or callus formation within the above prescribed period of time (5 to 8 weeks), but that they are very liable to do this if they are left in longer.

Fig. 5 (at left). Close range, shot gun, compound fracture of the humerus with burning and sloughing of three inches muscles and skin, outer aspect of the arm. Spiral fracture at bottom of wound. Operated ten days after injury. Complete cutting away of dead tissue, disinfection with iodine; banding and by extreme abduction, muscles and skin sutured, except for tubes for Dakin's solution. Healed with almost no suppuration, band removed six weeks with good union but not hard.

Fig. 6. Same as Fig. 5. Three months and 20 days after operation, showing straight humerus, firm bony union and extensive callus. Perfect functional result.

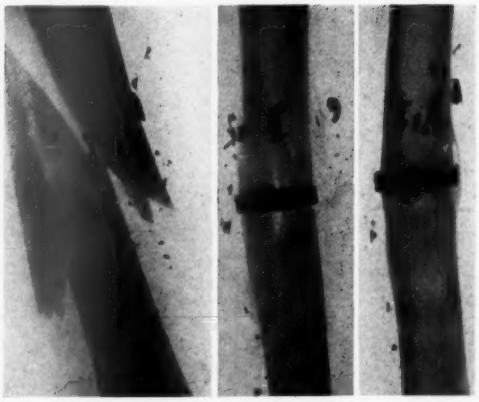


Fig. 7 (at left). Compound gunshot fracture humerus with hæmatoma and drop wrist. At operation muscolospiral nerve impaled on sharp point of distal fragment. This was relieved and the nerve wrapped in free fat envelope and bone banded. Dakin's solution discontinued in 5 days, followed by practically primary union.

Fig. 8. Same as Fig. 7, 2 months 23 days after operation. Bony union but not complete.

Fig. 9. Same as Figs. 7 and 8, 16 months after operation, band never having been removed showing that it is covered on one side with bone; that union is perfect, humerus straight and no evidence of the band doing harm. Function of the nerve and arm long since completely restored.

There is no form of external splinting that in the average case will maintain apposition of fragments at 100 per cent. The very best only have relative degrees of efficiency, but nowhere approximates 100 per cent. We are reporting in this article, only four cases as illustrative of where internal fixation is especially indicated and the good results obtained. We feel that it is of special value in fracture of the humerus, certain fractures of the femur, and in cases in which both bones of the leg are fractured and comminuted. If union fails in these compound fractures after internal fixation, as it sometimes will, we do not have the extensive deformity, overriding or angulation, which is so often difficult to overcome in operating for a non-union. Since the Parham-Martin band is made smaller than formerly and of a much more malleable metal, it is very easy to remove under a local anæsthetic, by enlarging the small sinus, straightening the hook end, and curving it to match the contour of the bone, then extracting it with a pair of bone forceps. The plate requires a larger incision for its removal, consists of a number of different pieces (including screws), perforates the marrow cavity and consequently, should never be used where the band will answer. If plates are used, the screw holes should always be curretted when the screws are removed.

CONCLUSIONS

1. We believe that temporary internal fixation of compound fractures should be more frequently used than has been done in the past, and that it will prevent many of the difficult reparative operations, which we have to do on non-union compound fractures.

2. We do not believe that it increases the incidence of infection, but reduces it in direct ratio to the fixation.

3. We do not believe that bands or plates should ever be used with the understanding or hope that they will remain permanently.

4. The value of bands and plates in preventing excessive deformity and in relieving pain, between and during dressings, is a very great asset.

5. We believe their use will occasionally prevent the loss of limb, where the displacement is likely to interfere seriously with the circulation or nerve function.

6. The Parham band is much to be preferred to the Lane's plate where it can be used, because in oblique and comminuted fractures, it is a better mechanical support and brings all the fragments into perfect apposition and does not open the medullary cavity with the possibility of infection and osteoporosis.

7. As complete external immobilization should be maintained, as would be if internal fixation were not used.

METHOD OF EXTERNAL FIXATION FOR FRACTURED FEMUR

By E. L. ELIASON, A.B., M.D., F.A.C.S., Philadelphia

APPRECIATING the difficulty experienced in accomplishing satisfactory fixation in fractures of the femur, I have endeavored to devise such a dressing.

A dressing in order to be efficient must (1) fix both fragments as well as the joint above and below in whatever position is desired, (2) permit proper bed care of the patient, which means permit his being moved or turned without danger of strain at fracture site, (3) provide dependable traction which can be maintained and the amount accurately registered at all times, permit (4) of its application with the least possible concurrent danger of displacement of the fragments at the time, and, lastly, allow a safe transfer of the patient from place to place.

The means at our disposal for accomplishing the above results are the Hawley fracture table, the direct bone extension pins or tongs, a scale registering extension and a frame after the Bradford idea, with modifications and extensions devised by the writer.

The Hawley table is well known by surgeons doing bone work and needs no description.

As further aids the writer has devised three additional appliances to be attached to the table. The first an adjustable extension that permits of traction in the extremely flexed thigh, a position which we sometimes need in fractures of the upper and lower extremities of the femur shaft.

To counteract such upward pull, use is made of the adjustable plate applied over Pou-

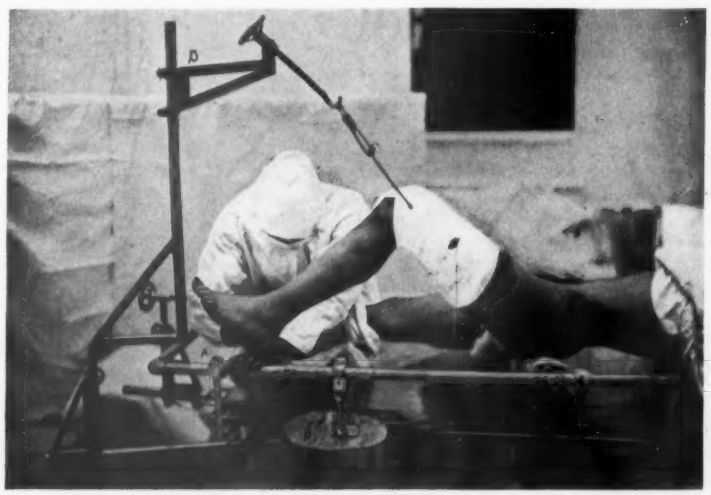


Fig. 1. Patient in position for application of bandage in fracture of femur.

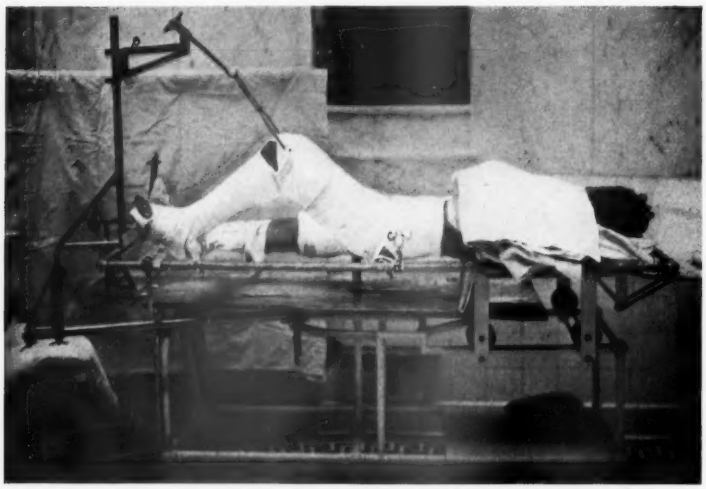


Fig. 2. Bandage applied to pelvis and down back of thigh extending under buttock to form a supporting cup.

part's ligament and the anterior superior spine of the ilium.

In order to hold the frame on the Hawley table, when the platform is lowered the stirrup attachments "A" are used.

The fracture frame is made of heavy pipes, the strength, length, and width varying with the size of the patient. A piece of heavy duck or canvas cut square to fit in the head of the frame, and with brass bound eyelets around 3 sides, is laced into the frame, held tightly with cotton rope. Laced separately and individually across the center of the frame are two stout canvas bands, 2½ to 3 inches wide, and of a length 4 inches shorter than frame width.

Across the foot end of the frame is laced a 6 inch wide similar strip of canvas. These strips all have brass bound eyelets, 3 or 4 in each end.

The two center strips are padded well with heavy felting or a thick layer of cotton.

Attached to each side of the frame, and detachable, is a short upright, which clamps the frame in any position, by means of corrugated jaws and a thumb screw. Fitted onto the upper end of this upright is a curved plate movable on a slotted stalk, which in turn clamps to the upright by a thumb screw. By loosening the screws the attachment can be placed at any level on the frame and in any position around the bar to which it is attached. Similarly constructed and attached to the lower end of the frame is a foot piece which can be adjusted to serve either on the sides or end of the frame, depending upon whether the limb is widely abducted over the side of the frame or simply fully extended.

To the side bars at the foot of the frame a bow of heavy iron is attached by thumb screw removable clamps. This bar carries an adjustable cross bar fitted with holes for pulley attachments throughout its length. A subsidiary strip of similar construction allows of extension beyond the sides of the frame.

The frame, stripped of its foot and bow attachments, and with the side clamps loosened and dropped below, is placed in the Hawley table, with the 2 narrow canvas strips taking position 4 inches to the head end side of the perineal post.

The patient is then placed upon the frame and table, with the perineum snugly against the well padded post and ether administered for either open or closed reduction. As almost all fractures of the femur demand for reduction, the thigh flexed on abdomen, and the knee flexed on the thigh, traction must be made and should be continued in this position (Fig. 1).

The traction on the lower fragment should be direct bone traction and this is accomplished by the Steinmann nail driven through the lower end of femur one-half inch above adductor tubercle. A Ransohoff or Syms tongs may be substituted for the nail. This is now attached by chain or rope to the author's attachment for traction in the flexed position (Fig. 1. *D*).

To prevent raising the patient from the table

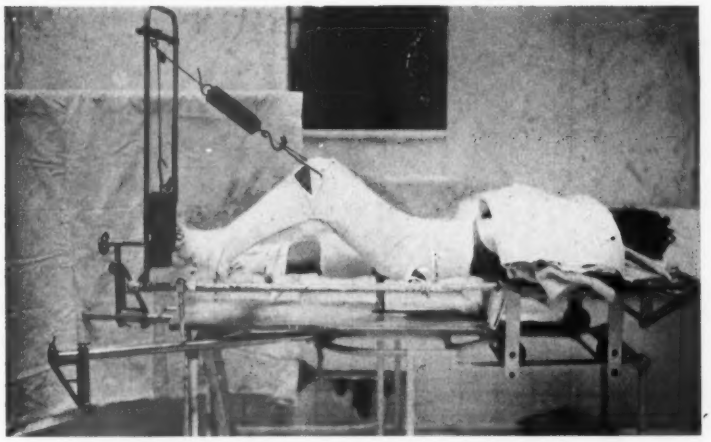


Fig. 3. The overhead bow is adjusted to the frame.

the counter plate is applied over the anterior superior spine. Properly placed screws hold it rigid in the perineal post.

We have a screw traction movable on a movable upright and a counter traction inguinal band or plate that grips the anterior superior spine of the ilium and prevents lifting the patient's buttock.

The extension or traction attachment *D* is a long, heavy upright rod, angled to swing free over the foot of the table. It fits into the socket of the foot clamp. At the top of the rod is an adjustable sliding bracket. To the extreme point of the bracket is fixed a tongued swivel socket through which passes a heavy threaded rod, armed on one end with a hook, by which traction is made. The swivel socket allows the screw traction to adapt itself to the line of pull.

The threaded rod is also grooved to accommodate the tongue of the swivel socket, thus preventing rotation of the hook. Fitted upon the thread is a hand wheel by which the traction is regulated.

The counter traction plate is made of steel of sufficient thickness to be rigid. It is flat with a broadened, fenestrated, down-curved end which makes it fit over the anterior superior spine.

The other end is slotted and adjustable by a binding thumb screw, to a corrugated upright which fits into the perineal post of the Hawley table. It is attached at any desired height by a thumb screw on the foot side of the post and the post itself is attached to the table by a centrally placed thumb screw below the platform and toward the head of the table.

The plate is readily adjustable for either side, any height and any length to fit different sized patients. By removing the binding screw it is easily slid out from under the plaster-of-Paris casing.

Traction may now be made to any degree of flexions or abduction that may be necessary and the fragments replaced by whatever method, closed or open, is being used. The number of pounds of traction is registered by an interposed scale and is continued for from 3 to 4 weeks, the number of pounds pull varying with age of fracture, amount of shortening, size of patient, and the type of fracture line.

The amount of pull or traction required to reduce a fracture increases enormously with age of fracture; after 10 days or 2 weeks there is a marked increase in amount needed to overcome the shortening, for firm fibrous organization of the extravasated blood has occurred by this time binding the contracted muscle banks together.

The more shortening there is, the more traction is needed. Old fractures with more than 2 inches shortening most frequently do not stretch much more than an inch to an inch and a half. These cases demand *slowly* increasing traction over a period of 15 to 30 minutes, watching the patient closely, as traction of 100 to 125 pounds shocks them severely.

Muscular adults with oblique or spiral fracture demand, after reduction, 30 to 40 pounds pull for few days, then just enough to counteract the approximate judged weight of the limb from the fracture site down. Transverse fractures with end-to-end approximation require

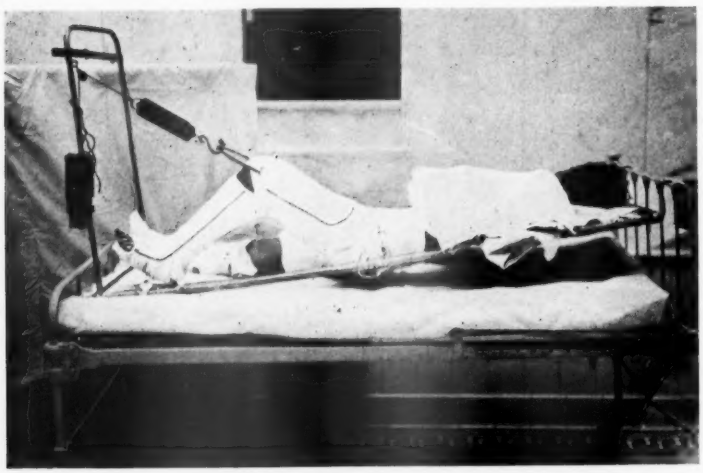


Fig. 4. The patient and frame transferred to the bed.

merely the traction corresponding to the limb weight.

The patient is now prepared for the plaster-of-Paris cast which extends from the umbilicus to and including the foot of the affected side and half way down the thigh on the uninjured side.

The table platform is then dropped and the head of the table is rolled toward the patient's head.

A thick padding of felt encompasses the pelvis with strips on each side of the perineum to catch the snugly fitting plaster. The limb is encased in cotton wadding or flannel. The sole of the foot is padded with a 2 inch layer of compressed cotton, which rests momentarily on the foot support of the frame.

Plaster is now applied over all with the exception of the foot. As the turns pass around the pelvis and waist but few, 4 or 5, should cross and bind the 2 pelvic canvas straps. Heavy reduplicated re-enforcements made by repeated layers of bandage folded one upon the other should be applied and molded closely along both sides of the pelvis. Down the back of the thigh extending under the buttock, so as to form a supporting cup, is molded a similar re-enforcement (Fig. 2).

After the cast is almost heavy enough the pelvic side braces *C* are turned up, fitted against the plaster and incorporated there with a few turns of plaster. On each side of the knee, a metal band, angled to suit the knee position and extending for 6 or 8 inches above and below are also incorporated with plaster, slightly back of the center line of the limb.

Placed under the foot, 2 or 3 inches from the sole, and extending up above the ankle, is a metal stirrup, which is bound to the leg above and rests on the foot support below. Plaster now binds the foot to the foot piece. Thus it is seen that the cast support and weight is transferred directly to the frame and no weight is carried by the foot. This is exceedingly important as patients cannot endure prolonged, even mild, pressure on the sole of the foot.

The stirrup should, in extending up the leg be kept back of the middle of the lateral aspect of the leg. The front half of the cast is now cut through from 3 inches below the groin to the toes, thus making a posterior trough.

The overhead bow is now adjusted to the frame and the extension transferred directly to it, the lateral arm being adjusted to suit the direction of traction (Fig. 3).

Three or 4 plaster layers are cut away over the two pelvic straps. The frame and patient are lifted into bed (Fig. 4).

The patient is attached to the frame in his plaster casing at four places, and his traction is also attached to the frame. This allows of lifting, turning, and tilting of the frame.

Four iron S hooks, two at head of bed and two at foot of bed are used to hold the frame off the mattress while the bed is changed or bed pan used. One, and then the other pelvic strip (never both at same time) is removed and the back attended to.

LATE PERFORATION OF A TYPHOID ULCER; LAPAROTOMY UNDER NOVOCAINE ANÆSTHESIA; RECOVERY

By H. C. COONEY, M.D., F.A.C.S., Princeton, Minnesota

PATIENTS with typhoid ulcer perforation who are surgically treated and recover are still sufficiently few and far between to justify a brief clinical mention of such a case to stimulate careful examination and prompt surgical intervention when the clinical findings are such that perforation of the intestine is a strong probability, as an absolutely correct diagnosis in the early hours is beset with difficulties, and textbook descriptions are misleading and furnish but little real guidance.

The occurrence of sudden severe abdominal pain with more or less shock, with or without nausea, or rigidity of the right lower quadrant in the first two or three hours, together with a small rapid pulse, are clinical symptoms of the greatest significance. The temperature at first may be depressed, but, in a few hours, in my case, it was markedly elevated.

My patient was a young male of twenty, who had been ill with a protracted typhoid fever between seven and eight weeks, and was in a much emaciated and exhausted condition. The diagnosis of probable perforation was based upon the occurrence of sudden abdominal pain (requiring morphia), slight right iliac tenderness, small rapid pulse (135, marked elevation of temperature 104—temperature taken four hours after onset of pain). There was no nausea nor abdominal rigidity. Exploratory laparotomy, under novocaine (½ of 1 per cent) infiltration anæsthesia, was performed four hours after the abdominal pain was first complained of, and a perforation of the ileum, six inches proximal to the ileocæcal valve, was demonstrated and closed by a pursestring linen suture, reinforced by an omental graft, as the bowel wall was too much indurated and friable to permit of invagination by the linen suture, which served however, to mechanically close the perforation against immediate leakage. Not much soiling of the peritoneum had taken place. Around the perforation there was considerable fibrinous exudate on the gut. As the appendix also showed some fibrinous exudate and injection (by contact) and contained several enteroliths, it was tied off with chromic catgut, the stump cauterized and a cigarette wick placed and the abdomen closed in layers. After twelve hours, water was given, and milk and broth in twenty-four hours. No infection took place about the drain, which was removed on the sixth day, and an uninterrupted convalescence followed. Very little discomfort was experienced by this patient at operation under novocaine anæsthesia.

The essentials are: to infiltrate the skin, or layer of tissue, and then wait four or five minutes before division of the infiltrated layer; repeat this process until the abdomen is open. Use gentle traction (or better none at all) on the abdominal wall and mesentery, and no pain of any consequence will be inflicted. Operate upon a reasonable probability of perforation. If we wait until we are absolutely certain of a diagnosis, i.e., signs which point to an evident peritonitis, that patient will most certainly die.

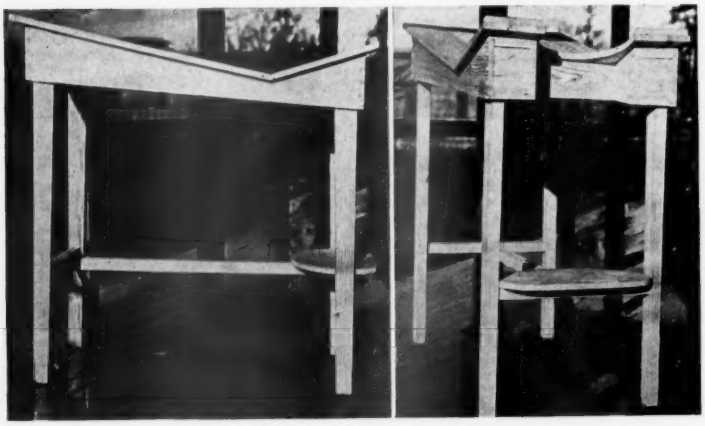
Exploratory laparotomy under novocaine anæsthesia properly performed results in little shock or pain to the patient. Its use is advocated, of course, in the typhoid fever patient whose condition, as a rule, contra-indicates any general anæsthetic.

AN ARMY CYSTOSCOPIC TABLE

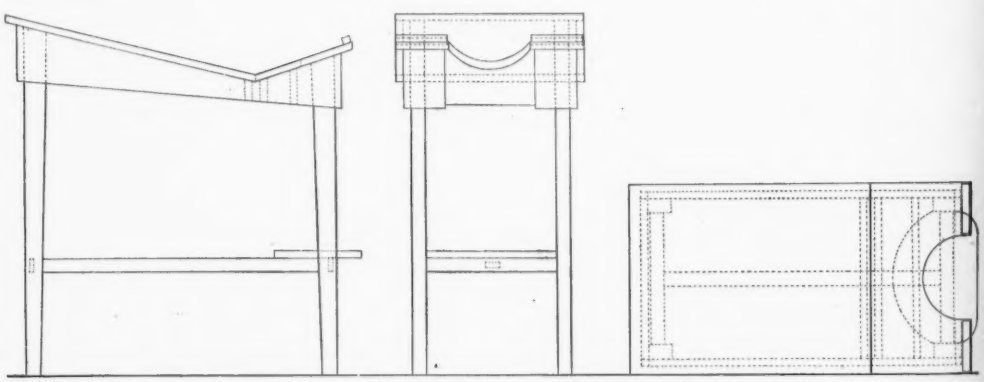
By Captain ALEXANDER HAMILTON PEACOCK, Medical Corps, U. S. A., Camp Lewis, Washington

ONE of the busiest wards of the camp hospitals serving the newly drafted army is the one devoted to urology. Many cases of chronic pyuria are not detected by the examining boards, due to lack of time and lack of special examinations, and the men are sent to camp and put to drilling, with the result that some of them break down and are sent to the base hospital for diagnosis and treatment. Hence many cystoscopic examinations are found necessary. In making these examinations, one of the first things appreciated is a good cystoscopic table, comfortable to both the patient and the examiner.

With the aid of several cabinet makers, the table here illustrated was built. It is four feet long, four feet high, and two feet wide. It is made of wood, with well mortised corners and cross bars. It is very strong and rigid. The center of gravity is high, but will be taken care of. The



Photograph of author's cystoscopic table.



Drawing showing construction of cystoscopic table.

table cannot be tipped. The patient reaches the top by means of a chair or a two step mount. The entire table takes up but little space. The feet do not slip off, the heel rests proving very efficient. After the patient gets into position, with the buttocks well down, he is told to relax fully, assuming the frog position, knees wide apart. This table has proved to be a very great help, making cystoscopy a pleasure, as it does not tire the patient and is very easy on the cystoscopist. Should he prefer sitting, a high stool is used by the examiner.

ADVANTAGES

1. The table is high enough so that the operator can easily demonstrate to others the various intravesicle lesions.
2. It is comfortable to the patient and comes closest to a posture of ease and relaxation, the shoulders, small of the back, and the buttocks being well supported.
3. Its construction is simple.
4. It can be made with lumber found around the new cantonments, though hard wood or sheet and tubular steel would be more permanent.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

THE sphynx of the body has again been questioned and is again found uncommunicative. This silent anatomic guest, the spleen, has been a source of wonder and speculation for years. Much and little has been attributed to it, but to date no tangible evidence is at hand to claim for it a rôle either in the production of disease or in maintenance of normal body functions. The authors of the work at hand[1] deserve untold praise for their untiring efforts in trying to establish some basic facts regarding the physiology of the spleen and its peculiar behavior under certain abnormal conditions. The experimental work carried on by Pearce is certainly painstaking and complete. Little is left to the imagination. By his experimental work certain facts are verified and definitely established. Many new avenues are opened and thoroughly explored, only to find them barren. The subjects of post-splenectomy anæmia, increased cell resistance and decreased tendency to jaundice are thoroughly verified but no distinct and infallible reasons recorded. The practical clinical views of the spleen are presented by Krumbhaar, holding constantly before the reader the result of experimental work in its relation to clinical findings and operative records. The spleen and its possible association to pernicious anæmia is also discussed, but withal nothing new is added. In a closing chapter, Frazier in brief presents the surgical treatment of lesions of the spleen. J. A. W.

TRANSFUSION of blood, although used centuries ago, has only in the past decade been perfected to such an extent as to place the procedure in the class of essentials. The early disastrous results were undoubtedly due to the lack of asepsis or to the lack in care in the procuring of blood which did not produce hæmolysis or agglutination in the recipient. Bernheim's monograph[2] is certainly opportune, since blood transfusion is beginning to find its way into military surgery and at present is employed with good results in certain types of shock following injury on the battle field.

The author considers his topic from a practical viewpoint, eliminating much technical detail. After discussing the phenomenon of bleeding and its diagnosis, he enters upon a logical and sane analysis of blood transfusion as it applies to various conditions. The technique of the transfusion of whole and citrated blood is given in a concise way. Dosage of blood and indications for its use are discussed. It is very apparent from the author's observations that transfusion is a valuable asset in the treatment of acute anæmias due to loss of blood from bleeding, and also in certain blood dyscrasias, but not the "cure-all" which certain men try to make it. It affords means for remissions in pernicious anæmias, leukæmia, hæmophilia, and the like, but no evidence is at hand that a cure has ever been attained. Favorable results are procured in melæna neonatorum and hæmolytic icterus, the latter when associated with splenectomy. The author gives the Moss classification of blood and the technique for testing blood for hæmolysis and agglutination by various methods.

The work is indeed a valuable addition to the surgical literature of the day and deserves study by every surgeon. J. A. W.

THE study of the internal secretions is at present in full swing and yet but few tangible facts are at hand. The one gland about which the universe of internal secretion revolves, the thyroid, has been studied for centuries and today many of its peculiar functions and reactions are known; yet the gland in its entirety, along with its special pathology, is yet a source of speculation. The work of Crotti[3] is surely a step forward as a systematic classification of our present day knowledge regarding this most essential organ. A short paragraph in the preface explains the attitude which the author assumes: "Some may find my statements dogmatic at times and my conclusions perhaps a little sanguine. I feel, however, that in the study of the problems of internal secretion, always tantalizing and interesting, accessibility to ideas is the one prerequisite to success for those who wish to gain achievement in the study and so long as we have not acquired the whole truth, opinions are of value provided they are substantiated by facts."

It is indeed a difficult task to enumerate the outstanding parts of this admirable work, since every phase of the goiter problem has been exhausted. It gives the reader much pleasure to know what is of historic interest regarding goiter, and this subject

[1] THE SPLEEN AND ANÆMIA. EXPERIMENTAL AND CLINICAL STUDIES. By Richard Mills Pearce, M.D., Sc.D., with the assistance of Edward Bell Krumbhaar, M.D., Ph.D., and Charles Harrison Frazier M D, Sc.D Philadelphia and London: J. B. Lippincott Company 1917

[2] BLOOD TRANSFUSION, HÆMORRHAGE, AND THE ANÆMIAS By Bertram M. Bernheim, A.B., M.D., F.A.C.S. Philadelphia and New York: J. B. Lippincott Company, 1917.

[3] THYROID AND THYMUS. By André Crotti, M.D., F.A.C.S., LL D. Philadelphia and New York: Lea & Febiger, 1918.

is treated so pleasantly. Having spent many years in Switzerland where goiter is so prevalent and having been in intimate touch with the masters of goiter surgery the author has an understanding which few may attain. Among the many points elaborated upon, the subject of hypothyroidism deserves especial mention; the reader is impressed with the obscurity of its symptoms, the delicate gradation of which emerges into hyperthyroidism, and vice versa.

Inflammatory conditions of the thyroid are taken up in a masterly way, and the possible association of thyroiditis to thyroid toxæmia discussed. One is impressed by the thoroughness and acumen of the author and if nothing else, he teaches us the necessity of close and painstaking observations of all patients, for what applies to the thyroid must also apply to other organs as well.

A hasty conclusion of many readers may be that the author acclaims an endless symptomatology to thyroid disease. A more close observation will contradict this, for the author takes pains to inform the reader many times of the complexity of the symptoms and that the various symptoms detailed are found but are not of necessity a part of the symptomatology of the condition in question.

The author should be congratulated on the production of so complete and interesting a work. Every reader will receive benefit by a careful study of its pages. It is meant for the internest and practitioner as well as for the surgeon. In fact the internest may be the most benefited by a careful survey. The beautiful edition in handsome binding, in clear type on excellent paper, and with beautiful illustrations is indeed a credit to the publishers as well as to the author. J. A. W.

FOR many years and even possibly at present the subject of urology has been considered by some not a specialty but a mere infant in the cradle of surgery. Since the advent of new diagnostic methods and the refinement in diagnosis and operative treatment, urology has come into its own, not only as a specialty, but one which demands much training and skill. In spite of the fact that there are in the hands of the profession a number of volumes dealing with the subject, the new work edited by Cabot[1] is an innovation. It is by far the most comprehensive study of its kind at present. The predominating spirit of this compilation is admirably expressed by the author in the preface as follows: "Our intention has been to give articulate expression to American urology and if in this we have been successful, the object has been achieved." The work consists of two volumes by American authors. Volume I, after an interesting chapter of historical interest, discusses the cystoscope and its use in the diagnosis in lesions of the urinary tract. Following this are considered diseases of the penis, urethra, scrotum, testicle, prostate, and seminal vesicles. Subdivisions of these topics are given in the form of intensive monographs by men of unquestionable ability and much new information is set forth. It is indeed pleasing to see a work in urology which is constructed along new lines, and although there may be some repetition or difference of opinion, yet it is the expression of the urologists of the day, and all add to the interest of the reader.

The work is well illustrated and a complete bibliography is given at the close of each chapter.

One can unhesitatingly say that the work brings the subject of urology down to the minute. After reading Young and Pilcher on the prostate, Keyes on strictures, Beer and Barney on the testicle, Corbus on syphilis and genital ulcers, one is satisfied that for the present at least the information is final. J. A. W.

[1] MODERN UROLOGY. Original contributions by American authors. Edited by Hugh Cabot, M.D., F.A.C.S Philadelphia and New York: Lea & Febiger, 1918. Vol. I.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

NEUROLOGICAL CLINICS. EXERCISES IN THE DIAGNOSIS OF DISEASES OF THE NERVOUS SYSTEM. Given at the Neurological Institute, New York. Edited by Joseph Collins, M.D. New York: Paul B. Hoeber, 1918.

MILITARY SURGERY OF THE ZONE OF THE ADVANCE. Medical War Manual No. 7. By George de Tarnowsky, M.D., F.A.C.S. Philadelphia and New York: Lea & Febiger, 1918.

SURGICAL AND WAR NURSING. By A. H. Barkley, M.D. (Hon.), M.C., F.A.C.S. St. Louis: C. V. Mosby Company, 1918.

A MANUAL OF OTOLOGY. By Gorham Bacon, A.B., M.D., F.A.C.S., assisted by Truman Laurance Saunders, A.B., M.D. Philadelphia and New York: Lea & Febiger, 1918.

MEMORANDA ON ARMY GENERAL HOSPITAL ADMINISTRATION. By various authors. Edited by P. Mitchell, M.D. (Aberd.) New York: Paul B. Hoeber, 1918.

WAR SURGERY OF THE ABDOMEN. By Cuthbert Wallace, C.M.G., F.R.C.S. (Eng.), M.D., B.S. (Lond.). Philadelphia: P. Blakiston's Son & Co., 1918.

CONCERNING SOME HEADACHES AND EYE DISORDERS OF NASAL ORIGIN. By Greenfield Sluder, M.D. St. Louis: C. V. Mosby Company, 1918.

THE ORTHOPEDIC TREATMENT OF GUNSHOT INJURIES. By Leo Mayer, A.M., M.D., with an introduction by Colonel E. G. Brackett, M.C., N.A. Philadelphia and London: W. B. Saunders Company, 1918.

GYNECOLOGY. By William P. Graves, A.B., M.D., F.A.C.S. 2d ed., thoroughly revised. Philadelphia and London: W. B. Saunders Company, 1918.

Clinical Congress
American College of Surgeons

NINTH ANNUAL MEETING
NEW YORK CITY
OCTOBER 21 TO 26, 1918

COMMITTEE ON ARRANGEMENTS

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Alfred T. Osgood
Wendell C. Phillips
John Rogers
Thomas A. Smith
Frederic E. Sondern
George D. Stewart
W. E. Studdiford
Alfred S. Taylor
Howard C. Taylor
Antoine P. Voislawsky
Charlton Wallace
George Gray Ward, Jr.
Wilbur Ward
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Frederick Whiting
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CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

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THE CLINICAL CONGRESS IN NEW YORK CITY

COMES now the announcement of the ninth annual session of the Clinical Congress of the American College of Surgeons, which meets this year for the first time as a part of the College. Again, as indicated by this program, the Congress will be the big military-medical meeting of the year. Leaders of the medical corps of England, France, and Italy, as well as leaders of the medical corps of the United States, will come on special leave to bring to the Congress their messages from the allied front, patriotic and scientific.

Already at the offices of the College more than twice the number of applications for the privilege of attending the Congress are on file than will be possible to accept. New York, the place of the meeting, is a world-center. But even in New York the available space at the clinics and at the scientific and military programs is limited. The attendance must be limited in accordance with this capacity.

A surplus number of candidates to attend the Congress has characterized the organization from the beginning. That fact alone is a verdict of the medical profession as to the need of the Congress. It is without parallel among medical societies; and the reasons are not far to seek. Some review of these reasons of success are here appropriate.

First, the Congress was born out of high-minded medical patriotism. Surgeons come to its sessions conscious that what they are to carry away with them depends chiefly upon what they bring with them. And they bring their best fellowship, their highest eagerness to make better surgeons of themselves. The Congress is the surgical exchange of the western world. It is a national occasion when a great group of the medical profession rise to sound and serious analyses of their work.

Second, long ago the Congress recognized that the medical profession tends too easily to accept or to tolerate its failures as necessary evils. In opposition to this attitude the Congress from the beginning has shown admirable power to face facts and to strike forward. It has built no pleasant fictions around facts as they are; nor has it ever accepted mere criticism as a cure. Accurate data, understanding of the data, and then prompt and fearless action, are its characteristic procedure. Drawn together by bonds of long friendship, the members of the Congress get their "second wind," so to speak, in dealing with things which concern the profession. They have power beyond power to go ahead. The American College of Surgeons, for instance, had its beginning in the Congress. The standardization of hospitals first fluttered toward actuality in the Congress. What we may call historical imagination has played a strong part in the Congress. History can never tell the story of the thousands of lives which have been saved because surgeons, in close association at the Congress, not only grasped new inspiration to do better work, but also because they got new knowledge of the advance of surgery.

Again, let us emphasize the value of intimate personal exchange. Creative work, such as surgery is, half an art and half a science, demands inspirational association, such as the Congress offers, for its highest attainments. It demands fresh and fiery energy, new wonder and new joy in all of its intricate processes. To meet these demands with directness and with nobility is an important mission of the Congress.

HOSPITAL STANDARDIZATION

The morning and afternoon sessions of Wednesday are to be given over to hospital standardization. To these sessions leading hospital superintendents of Canada and of the United States will be invited as well as members of the Congress.

Details of the program on hospital standardization are at this time only partially complete. The morning session will be devoted to a review of what has been accomplished by the College in this field during the past year. Mr. John G. Bowman, Director of the College, will present facts alive with interest to the profession and to hospitals. To what extent do hospitals provide adequate laboratory facilities for the right care of their patients? To what extent do hospitals, as a matter of responsibility to their communities, insist that all cases in their care be given thorough study and consecutive attention? To what extent are case records properly written? What control is exercised by hospitals over the privilege of practice in their respective buildings? These and other questions will be dealt with now on the basis of facts, facts gathered by the College during the past year.

Charles B. Moulinier, S. J., President of the Catholic Hospital Association and member of the staff of the College, will tell of hospital progress among Catholic hospitals during the past year. The high incentive with which Catholic hospitals have taken up the hospital plan of the College is already widely known. Father Moulinier's address will also come in the morning session.

During the afternoon session all subjects and discussions are to bear upon hospital progress for the coming year. Obviously the equation of the war among civilian hospitals must first be clearly stated. Brigadier General Robert E. Noble, of the Surgeon General's office, will present this subject.

Have hospitals "sold" themselves to their communities? What are the terms of such a sale? Dr. W. A. Evans, Chicago, has analyzed this problem in a practical matter-of-fact way and at the conference will touch the fundamental basis of hospital standardization.

A subject of vital interest growing out of the work of standardization is the right limitation to the privilege of practice in hospitals. Dr. John T. Bottomley, Boston, will deal with this question. The meaning of case records, both in military and civilian hospitals, and special problems of small hospitals in meeting the standard of the College will also be emphasized.

Time is provided for discussion of the various subjects and plans of action that will be presented. The closing summary of the day will be made by Dr. W. J. Mayo, Rochester.

THE CLINICAL PROGRAM AND GENERAL PLAN OF MEETING

Five full days of clinics and demonstrations in the hospitals, medical schools and laboratories of New York City and Brooklyn, with evening meetings in the Ballroom at the Waldorf-Astoria, devoted to the reading and discussion of papers on all phases of surgery of the war, constitutes the program for the Ninth Annual Session of the Clinical Congress of the American College of Surgeons.

Clinical demonstrations will occupy the morning and afternoon hours of each day. The Committee on Arrangements, heartily supported by the clinicians of New York City and Brooklyn, are keenly interested in making a complete showing of their clinical facilities in all departments of surgery, including gynecology, obstetrics, genito-urinary surgery, orthopedics and surgery of the eye, ear, nose, throat and mouth. In addition to the operative clinics the Committee has arranged for a series of demonstrations in surgical pathology, roentgenology and borderline subjects.

So far as is possible the clinical demonstrations will deal with phases of modern military surgery and will include many of the notable advances in methods of caring for the sick and wounded, as developed during the past four years, emphasizing particularly the newer methods employed in the treatment of fractures, head and chest injuries, wound infections, etc.

A feature which has proved of great interest at previous sessions, the cinematographic exhibitions of surgical operations, will be continued at this meeting, depicting the newer as well as the classical operations as performed by eminent specialists. These exhibitions will be given each afternoon in the Ballroom of the Waldorf-Astoria.

In the following pages is published a tentative outline of the clinical program,— the real program of the Congress will be bulletined each afternoon at headquarters and will be elaborate and accurate in detail as to the cases to be operated upon or demonstrated in the several clinics on the succeeding day. Printed programs containing the same information will be issued each morning.

LIMITED ATTENDANCE—ADVANCE REGISTRATION

The popularity of these clinical meetings has proved so great that it has been found necessary in recent years to adopt the plan of limiting the attendance and requiring advance registration. A survey of the operating amphitheaters, lecture rooms and laboratories in the hospitals and medical schools as to their capacity for accommodating visiting surgeons has been made and the limit of attendance based thereon. Visiting surgeons are thus assured that there will be accommodations at the clinics for all who receive cards.

The total of registrations received at this date indicates that the limit of attendance will be reached in advance of the opening of the session. Available accommodations will not permit of our accepting all applications for registration, which will be disappointing to hundreds of enthusiastic surgeons who have attended previous meetings. When the limit of attendance has been reached through advance registration, no further registrations will be accepted.

To each surgeon registering in advance a formal receipt for the registration fee has been issued, which receipt is exchangeable for a general admission card at headquarters upon his arriva'. This card, which is non-transferable, must be presented to secure clinic tickets and admission to the evening meetings. Headquarters at the Waldorf-Astoria will be open for registration on Sunday, October 20th, for the convenience of members arriving in the city on that day. The clinical program for Monday will be bulletined at headquarters on Sunday and special tickets for Monday's clinics will be issued as visiting surgeons register.

CLINIC TICKETS

Attendance at all clinics and demonstrations is controlled by means of special clinic tickets, the number of tickets issued for any clinic or demonstration being limited to the capacity of the room in which the clinic or demonstration is to be given. As a general rule one may have two tickets for each day, one for a morning and one for an afternoon clinic, but for certain clinics where the accommodations are limited and the demand for tickets is heavy, the rule will be that a visitor may have but one ticket for such clinic during the week. The use of special clinic tickets has proven an efficient means of providing for the distribution of members among the several clinics and insures against overcrowding at any clinic.

Clinic tickets will be issued each morning at 8 o'clock for the clinics and demonstrations to be given that day, a complete schedule of the day's clinics having been posted on the bulletin board on the afternoon of the preceding day. After the program has been posted, reservations for tickets for the next day's clinics may be filed, the tickets to be issued the next morning. Printed programs will be issued each morning, containing the complete clinical program, with announcements for the evening session, business meetings, etc.

REGISTRATION FEE

A registration fee is required of each surgeon attending an annual meeting, the receipts from registration fees providing the funds with which to meet the expenses of preparing for and conducting such meetings, so that no financial burden is imposed upon the members of the profession in the city entertaining the Congress.

HEADQUARTERS

Headquarters will be established at the Waldorf-Astoria and McAlpin Hotels. At the former the Grand Ballroom, Astor Gallery, Myrtle and East Rooms, together with other large public rooms and foyers, have been reserved for the use of the Congress for its registration and ticket bureau, bulletin rooms, etc. The Grand Ballroom will be used for the large general sessions, afternoon and evening, cinematographic exhibitions, etc. The Hotel McAlpin, with its large number of guest rooms, under the same management as the Waldorf-Astoria and located in the same block, will be able to take care of a very large number of the visiting surgeons.

PROGRAM OF EVENING MEETINGS

Five great war meetings, at which eminent surgeons of the English, French, Italian and American army medical services will discuss various phases of modern military surgery and the achievements of medical science during four years of war, is the program outlined for the evening sessions to be held in the Grand Ballroom of the Waldorf-Astoria during the week of the Congress. Surgery in the field, in base, evacuation and reconstruction hospitals, will be the general topic for consideration. A tentative outline of the program for these evening sessions follows:

Monday—Presidential Meeting

Address by Chairman of Committee on Arrangements—J. BENTLEY SQUIER, M.D., New York.

Address by Retiring President—JOHN G. CLARK, M.D., Philadelphia.

Inauguration and Presidential Address—WILLIAM J. MAYO, M.D., Rochester, Minn.

Addresses: Surgeon General of the Army, Surgeon General of the Navy, Surgeon General of the Public Health Service, and invited European and American military and civil surgeons, including PROFESSOR RAFFAELE BASTIANELLI, Rome, Italy; SIR ROBERT JONES, Liverpool, England; PROFESSOR THEODORE TUFFIER, Paris, France; MAJOR GENERAL MERRITTE W. IRELAND, M.C., U.S.A.; BRIGADIER GENERAL ROBERT E. NOBLE, M.C., U.S.A., COLONEL JOSEPH A. BLAKE, M.C., U.S.A., COLONEL GEORGE W. CRILE, M.C., U.S.A., COLONEL FREDERIC A. BESLEY, M.C., U.S.A., W. W. CHIPMAN, M.D., Montreal, Canada.

Tuesday

Symposium on War Surgery:
DR. PIERRE DUVAL, Paris, France.
COLONEL CHARLES H. PECK, M.C., U.S.A.
GENERAL ANTOINE DEPAGE, LaPanne, Belgium.
COLONEL GEORGE W. CRILE, M.C., U.S.A.

Wednesday

Symposium on War Surgery:
MAJOR GENERAL MERRITTE W. IRELAND, M.C., U.S.A.
COLONEL CUTHBERT WALLACE, British Army Medical Service.
COLONEL GOSSET, French Army Medical Service.
COLONEL FREDERIC A. BESLEY, M.C., U.S.A.
MAJOR R. LEDEAUX-LEBARD, Chief of Radiologic Service, Hospital Descartes, Tours, France.

Thursday

Symposium on War Surgery:
SIR ROBERT JONES, Liverpool, England.
LIEUTENANT COLONEL CLARENCE L. STARR, Canadian Army Medical Service.
COLONEL FRANK BILLINGS, M.C., U.S.A.
COLONEL GEORGE E. BREWER, M.C., U.S.A.
COLONEL JOSEPH MILLER, M.C., U.S.A.
MAJOR ALEXIS MOSCHCOWITZ, M.C., U.S.A.

Friday—Convocation of American College of Surgeons

Conferring of honorary fellowships.
Presentation of candidates for fellowship.
Address: Hospital Standardization—JOHN G. BOWMAN, Director, American College of Surgeons.
Presidential address—WILLIAM J. MAYO, M.D., Rochester, Minn.
Fellowship address.

PRELIMINARY CLINICAL PROGRAM

CLINICS IN NEW YORK CITY

GENERAL SURGERY

Bellevue Hospital

NATHAN W. GREEN and EUGENE DRAPER—Chest and abdominal surgery, operations and exhibit of cases.

DRS. VAUGHAN and F. W. GRAVELLE—Carrell-Dakin treatment of wounds in general surgery.

DONALD GORDON and GASTON A. CARLUCCI—Cases illustrating treatment of compound fracture; special splint for fractured femur.

FREDERIC MONTGOMERY — Methods of administering ether.

JOHN ROGERS — Surgical treatment of thyroids.

GEORGE D. STEWART — Stomach and gall-bladder surgery.

JOHN DOUGLAS — Stomach and gall-bladder surgery.

WALTER C. CRAMP — Acute abdominal surgery; fractures.

GEORGE D. STEWART and W. HOWARD BARBER — Results in surgical treatment of ulcer and cancer of stomach, perforating ulcer of stomach, perforating appendicitis. Exhibit from the Surgical Laboratory of the University and Bellevue Hospital Medical College: (a) experiments in uretero-enteric anastomosis; (b) experiments in gastrectomy (partial) and gastro-enterostomy; (c) experimental demonstration in the treatment of ileus and surgical constipation.

F. A. SMITH — Surgery of children.

VINCENT GAUDIANI and GEORGE D. STEWART — Construction of kineplastic flaps in amputation.

City Hospital

NATHAN W. GREEN, JOSEPH ROBERTSON and DR. ARMSTRONG — Abdominal surgery.

Correctional Hospital

W. TRAVIS GIBB, FRANK C. YEOMANS and W. H. STRATFORD — General surgery.

Flower Hospital

LOUIS R. KAUFMAN — Nephrectomy; intraventricular salvarsan serum treatment; salvarsan administration by a new apparatus; gastric ulcer (gastro-enterostomy, pyloric occlusion).

ANSON H. BINGHAM — Treatment of tubercular abscess; demonstration of Cabot method; astragalectomy in poliomyelitis cases.

E. WELLES KELLOGG — Results of fractures treated by mobilization and massage, in comparison with those treated by immobilization (radiographs and patients).

O. R. VON BONNEWITZ — Repair of sphincters in fæcal incontinence showing a new hour-glass and splint; typical case of pruritus ani.

GEORGE W. LUTTON — Relief of obstructive jaundice.

French Hospital

J. P. HOGUET and M. I. BLANK — General surgery.

Gouverneur Hospital

ERWARD L. KELLOGG and ALBERT SELLENINGS — Acute abdominal surgery.

Hahnemann Hospital

G. W. ROBERTS, W. G. CRUMP, H. A. FOSTER, SPRAGUE CARLETON, J. H. FORBES and H. B. SAFFORD — General surgery.

Harlem Hospital

H. A. HAUBOLD — General surgery.

Memorial Hospital

H. H. JANEWAY — Radium treatment of cancer.

WILLIAM B. COLEY — Treatment of inoperable sarcoma with the mixed toxins of erysipelas and bacillus prodigiosus.

BENJAMIN S. BARRINGER — Radium treatment of carcinoma of the prostate and bladder.

DRS. MALLETT and BAILEY — Method of application of radium.

Metropolitan Hospital

C. L. BAGG, R. F. WARD, W. F. HONAN, J. H. FORBES and H. B. SAFFORD — Male surgery.

Mt. Sinai Hospital

DRS. BERG, LEWISOHN, GERSTER and BELLER — Surgery of the stomach, intestines and rectum.

DRS. WIENER, WARE and THALHIMER — Surgery of the bones and joints.

DRS. ELSBERG, TAYLOR and WILENSKY — Surgery of the brain and spinal cord.

Neurological Institute

C. A. ELSBERG and A. S. TAYLOR — Neurological surgery.

New York Hospital

C. L. GIBSON, J. M. HITZROT, C. E. FARR, S. ERDMAN, J. A. VIETOR and E. M. HAWKES — General surgery.

Polyclinic Hospital

JOHN A. WYETH — Destruction of inoperable vascular neoplasms with hot water injections.

WILLIAM SHARPE — Brain surgery.

JEROME M. LYNCH — Carcinoma of rectum; suppurative colitis; reconstruction of colon of elbow deformity.

Presbyterian Hospital

A. V. S. LAMBERT — Stomach, gall-bladder, spinal cord and brain surgery.

E. T. RULISON — Appendix and hernia cases.

HUGH AUCHINCLOSS — Female mammary gland surgery.

A. O. WHIPPLE — Gall-bladder surgery.

J. M. HANFORD — Lymph glands and hernia surgery.

FORBES HAWKES — Uterus, appendix and hernia cases.

J. BENTLEY SQUIER and JOSEPH F. MCCARTHY — Bladder and kidney surgery.

DRS. CORSCADEN and HANFORD — Demonstration of method of radiotherapy and exhibition of cases.

DRS. LAMBERT, HAWKES, AUCHINCLOSS, CARSCADEN, WHIPPLE, RULISON and HANFORD — Demonstration of methods of "follow-up" system.

W. C. CLARKE and assistant — Surgical laboratory, demonstration of methods of keeping records and of "follow-up" system on malignant growths. Record room, demonstration, explanation of details of Columbia system of keeping records, terminology, filing system, unit history, binding of histories, "follow-up," interval results, etc.

Roosevelt Hospital

CHARLES H. PECK, SETH MILLIKEN, CHARLES N. DOWD and LUCIUS W. HOTCHKISS — General surgery.

Hospital for Ruptured and Crippled

WILLIAM B. COLEY and JOSEPH P. HOGUET — Radical cure of hernia.

Skin and Cancer Hospital

Operations and demonstrations of cases.

St. Francis Hospital

DRS. ROGERS, CRAMP, EDGERTSON and HARRIGAN — General surgery.

St. Luke's Hospital

WILLIAM A. DOWNES, WALTON MARTIN, NATHAN GREEN, FRANK S. MATHEWS, JOHN DOUGLAS and WINFIELD S. SCHLEY — General surgery.

St. Mary's Hospital

FRANK S. MATHEWS, EDWARD TRUESDELL and CHARLES E. FARR — General surgery.

St. Vincent's Hospital

JOSEPH B. BISSELL — Gall-bladder surgery.
ERNEST FAHNESTOCK — Acute surgery.
GEORGE D. STEWART — Gastric cases, duodenal ulcer cases.

GYNECOLOGY

Monday

HIRAM N. VINEBERG — Mount Sinai Hospital — 2.
JOSEPH BRETTAUER — Mount Sinai Hospital — 1:30.
FRANK R. OASTLER and EDWARD T. HULL — Lincoln Hospital — 3.
LEROY BROUN — Woman's Hospital — 2.
DOUGAL BISSELL — Woman's Hospital — 8:30.

Tuesday

EDWIN B. CRAGIN — Sloane Hospital — 3.
FRANK R. OASTLER — Lenox Hill Hospital — 9:30.
G. SEELIGMANN — Lenox Hill Hospital — 9.
HOWARD C. TAYLOR — Roosevelt Hospital — 9.
G. G. WARD, JR.— Woman's Hospital — 2.
HERMANN GRAD — Woman's Hospital — 8:30.
C. G. CHILD — Polyclinic Hospital — 9.
WILLIAM P. HEALY — Fordham Hospital — 9.
A. STEIN — Lenox Hospital — 2.
S. W. BANDLER — Post Graduate Hospital — 9.
G. SEELIGMANN — Lebanon Hospital — 9.

Wednesday

H. DAWSON FURNISS — Post-Graduate Hospital — 9.
I. S. HAYNES — Harlem Hospital — 2.
DOUGAL BISSELL — Woman's Hospital — 2.
WILLIAM P. HEALY — Roosevelt Hospital — 9.
A. STEIN — Harlem Hospital — 2.

Thursday

HIRAM N. VINEBERG — Mount Sinai Hospital — 2.
JOSEPH BRETTAUER — Mount Sinai Hospital — 1:30.
HOWARD C. TAYLOR — Roosevelt Hospital — 2:30.
I. S. HAYNES — Park Hospital — 2.
LEROY BROUN — Woman's Hospital — 2.
C. G. CHILD — Polyclinic Hospital — 9.
M. ROBINSON — Beth Israel Hospital — 2.
S. W. BANDLER — Beth Israel Hospital — 2.
G. SEELIGMANN — Lebanon Hospital — 2.

Friday

FRANK R. OASTLER — Lenox Hill Hospital — 2:30.
G. SEELIGMANN — Lenox Hill Hospital — 2.
G. G. WARD, JR.— Woman's Hospital — 2.
HERMANN GRAD — Woman's Hospital — 8:30.
S. W. BANDLER — Post Graduate Hospital — 9.

Days and hours to be announced

J. C. TAYLOR — Polyclinic Hospital.
T. H. MORGAN — Polyclinic Hospital.
L. J. LADINSKI — Polyclinic Hospital.
WILLIAM E. STUDDIFORD — Bellevue Hospital.
J. N. WEST — Post Graduate Hospital.
M. CATURANI — Italian Hospital.
H. S. STEARNS — City Hospital.
WALTER G. CRUMP — Hahnemann Hospital, New York Medical College for Women, Broad Street Hospital.

ORTHOPEDIC SURGERY

Monday

New York Orthopedic Hospital — 9, operations; 1:30, out-patient clinic.
Clinic for Functional Re-Education of Disabled Soldiers and Sailors — 10 to 4, out-patient clinic.
Hospital for Ruptured and Crippled — 1, operations; 1 to 3, out-patient clinic.
Bellevue Hospital — 3, out-patient clinic.
Post Graduate Hospital — 4:30, operations.
Hospital for Deformities and Joint Diseases — 2 to 3.

Tuesday

Hospital for Deformities and Joint Diseases — 8:30, operations; 2 to 3, out-patient clinic.
Hospital for Ruptured and Crippled — 9, operations; 1 to 3, out-patient clinic.
New York Orthopedic Hospital — 9, operations; 1:30, out-patient clinic.
Post Graduate Hospital — 9 and 4:30, operations.
Clinic for Functional Re-Education of Disabled Soldiers and Sailors — 10 to 4, out-patient clinic.
Bellevue Hospital — 2, out-patient clinic; 3, operations.
St. Luke's Hospital — 3:30, operations.

Wednesday

Hospital for Ruptured and Crippled — 9, operations; 1 to 3, out-patient clinic.
New York Orthopedic Hospital — 9, operations; 1:30, out-patient clinic.
Clinic for Functional Re-Education of Disabled Soldiers and Sailors — 10 to 4, out-patient clinic.
Hospital for Deformities and Joint Diseases — 2 to 3, out-patient clinic.
Bellevue Hospital — 3, out-patient clinic.
Post Graduate Hospital — 4:30, operations.

Thursday

New York Orthopedic Hospital — 9, operations; 1:30, out-patient clinic.
Hospital for Ruptured and Crippled — 9, operations; 1 to 3, out-patient clinic.

Hospital for Deformities and Joint Diseases — 8:30, operations; 2 to 3, out-patient clinic.
Bellevue Hospital — 2, out-patient clinic; 3, operations.
Clinic for Functional Re-Education of Disabled Soldiers and Sailors — 10 to 4, out-patient clinic.

Friday

Bellevue Hospital — 3, out-patient clinic.
Hospital for Deformities and Joint Diseases — 8:30 and 2 to 3, out-patient clinic.
New York Orthopedic Hospital — 9, operations; 1:30 out-patient clinic.
Clinic for Functional Re-Education of Disabled Soldiers and Sailors — 10 to 4, out-patient clinic.
Hospital for Ruptured and Crippled — 1 to 3.
St. Luke's Hospital — 3:30, operations.

UROLOGY

Monday

Drs. Buerger, Hyman and Aschner — Mt. Sinai Hospital — 1:30. Operations on kidney, ureter, bladder, and prostate. Demonstration of cases.
G. W. Swinburne and Assistants — Good Samaritan Hospital Dispensary — 10. Out-patient clinic.
Drs. Ackerman, Zahler, Panof and Friedman — St. Mark's Hospital — 9. Out-patient clinic.
Victor C. Pedersen — St. Mark's Hospital — 11. Operations and demonstrations.
Joseph J. Asch — Lenox Hill Hospital — 2. Demonstrations in general urology and cystoscopy.
Frederic Bierhoff and L. L. Michel — West Side German Dispensary.
H. S. Jacks — Bellevue Hospital. Demonstration of pathological material and methods in urology.
B. S. Barringer — Bellevue Hospital — 2. Kidney and prostate operations.

Tuesday

Drs. Buerger, Hyman and Aschner — Mt. Sinai Hospital — 9. Operative cystoscopy. New method of treating filiform stricture of urethra through the universal urethroscope. Method of dilating ureter for descending ureteral calculi. Snaring of papillomata. Cystoscopic and urethroscopic diagnosis. Pathology of urological lesions and contraction of the neck of the bladder.
Max Huehner — Mt. Sinai Hospital — 9. Demonstrations in diagnosis and care of sexual neurasthenia pollutions, etc.; care of bladder tumors.
M. W. Ware — Mt. Sinai Hospital — 2. Operative clinic.
G. W. Swinburne and Assistants — Good Samaritan Hospital Dispensary — 10. Out-patient clinic.
Drs. Ackerman, Zahler, Panof, and Friedman — St. Mark's Hospital — 9. Out-patient clinic.
F. Ackerman — St. Mark's Hospital — 11. Operations.
H. G. Bugbee and F. E. Dubois — Woman's Hospital — 10. Operations and demonstrations.
Drs. Ayres and Carleton — Flower Hospital — 3. Bladder cases; operations and demonstrations.
Oswald S. Lowsley — Bellevue Hospital — 2. Operations and demonstrations.
Drs. Furniss, Bullard and Perilli — Post Graduate Hospital — 2. Cystoscopic clinic.
Maximilian Stern — Broad Street Hospital — 2. Demonstrations of vesical neck obstructions and urethral strictures with new operating urethroscope. Hyperæmia treatment of urethral stricture. Operations.

Wednesday

Drs. Buerger, Hyman, and Aschner — Mt. Sinai Hospital — 9. Operative cystoscopy. New method of treating filiform stricture of urethra through the universal urethroscope. Method of dilating ureter for descending ureteral calculi. Snaring of papillomata. Cystoscopic and urethroscopic diagnosis. Pathology of urological lesions and contraction of the neck of the bladder.
Leo Buerger — Polyclinic Hospital — 3:30. Operations on kidney and ureter.
G. W. Swinburne and Assistants — Good Samaritan Hospital Dispensary — 10. Out-patient clinic.
Drs. Ackerman, Zahler, Panof, and Friedman — St. Mark's Hospital — 9. Out-patient clinic.
Victor C. Pedersen — St. Mark's Hospital — 11. Operations and demonstrations.
Joseph J. Asch — Lenox Hill Hospital — 2. Demonstrations in general urology and cystoscopy.
H. G. Bugbee and F. E. Dubois — St. Luke's Hospital — 10. Operations and demonstrations.
Drs. Carleton and Halfman — Metropolitan Hospital — 3. Operative clinic.
Frederic Bierhoff and L. L. Michel — West Side German Dispensary.
Oswald S. Lowsley — New York Hospital — 10. Surgery and surgical pathology of the human prostate gland and seminal vesicles, demonstrated by lantern slides. Renal and ureteral lithiasis, demonstrated by specimens and lantern slides.
Charles J. Goeller — New York Hospital — 10. Acute epididymitis; its treatment, surgical and non-surgical.
Max S. Rolide — New York Hospital — 10. Gonorrhœal infection of the kidney; demonstration of two proved cases.
Frank Dealey — New York Hospital — 10. Pathological conditions of the bladder shown by cystoscopy.
B. S. Barringer — Memorial Hospital — 2. Radium treatment of carcinoma of bladder and prostate.
H. Dawson Furniss — Post Graduate Hospital — 9. Operative clinic (women).
Eugene Fuller — City Hospital — 2. Operative clinic.

Thursday

Drs. Buerger, Hyman, and Aschner — Mt. Sinai Hospital — 1:30. Operations on kidney, bladder and prostate. Demonstration of cases.
Max Huehner — Mt. Sinai Hospital — 9. Demonstrations in diagnosis and care of sexual neurasthenia pollutions, etc.; care of bladder tumors.
G. W. Swinburne and Assistants — Good Samaritan Hospital Dispensary — 10. Out-patient clinic.
Drs. Ackerman, Zahler, Panof, and Friedman — St. Mark's Hospital — 9. Out-patient clinic.
H. G. Bugbee and F. E. Dubois — Woman's Hospital — 10. Operations and demonstrations.
Oswald S. Lowsley — Bellevue Hospital — 2. Lesions of the external genitalia; exhibition of patients and lantern slide demonstrations. Malignant growths of urological organs, demonstration of postoperative patients.
Maximilian Stern — Broad Street Hospital — 2. Demonstrations of vesical neck obstructions and urethral strictures with new operating urethroscope. Hyperæmia treatment of urethral stricture. Operative clinic.

DRS. FURNISS, BULLARD and PERILLI — Post Graduate Hospital — 9. Cystoscopic clinic.

Friday

G. W. SWINBURNE and Assistants — Good Samaritan Hospital Dispensary — 10. Out-patient clinic.

DRS. ACKERMAN, ZAHLER, PANOF, and FRIEDMAN — St. Mark's Hospital — 9. Out-patient clinic.

F. ACKERMAN — St. Mark's Hospital — 11. Operations.

VICTOR C. PEDERSEN — St. Mark's Hospital — 11. Operations and demonstrations.

JOSEPH J. ASCH — Lenox Hill Hospital — 2. Demonstrations in general urology and cystoscopy.

M. W. WARE — Mt. Sinai Hospital — 9. General clinic.

H. G. BUGBEE and F. E. DUBOIS — St. Luke's Hospital — 10. Operations and demonstrations.

FREDERIC BIERHOFF and L. L. MICHEL.— West Side German Dispensary.

OSWALD S. LOWSLEY — Bellevue Hospital — 2. Operations and demonstrations.

Days and hours to be announced

A. L. WOLBARST — Beth Israel Hospital — Vasopuncture. Litholapaxy. Catheterization of ejaculatory canals. Epididymo-vasostomy (Martin). Cystoscopic and urethroscopic demonstrations.

EUGENE FULLER — Post Graduate Hospital — Seminal vesiculotomy.

PATHOLOGY

J. R. LOSEE — Lying-in Hospital — Daily, 9 to 5. Museum specimens of obstetrical and prenatal pathology.

DR. STRONG — Woman's Hospital — Daily.

D. SYMMERS and A. V. ST. GEORGE — Bellevue Hospital — Thursday, 11. Anatomical and histological preparation of surgical specimens.

J. E. MCWHORTER — Bellevue Hospital — Monday, 11. Experimental observations on the healing of wounds, with lantern demonstration.

S. S. DIXON — New York Eye and Ear Infirmary — Monday and Wednesday, 10. Exhibition of macroscopical eye specimens.

OPHTHALMOLOGY

Monday

DR. DIXON — New York Eye and Ear Hospital — 11. X-ray localization for foreign body in eye and orbit.

DR. REESE — New York Eye and Ear Hospital — 2. Ptosis, modified Machek. Resection for convergent and divergent strabismus. Extirpation lacrymal sac. Cataract extraction, La Grange operation.

DR. SHANNON — Manhattan Eye and Ear Hospital — 2. Elliot trephining, cataract extraction (combined).

DR. CASSELL — Manhattan Eye and Ear Hospital — 2. Cataract extraction, Kalt suture. Iridectomy.

DR. ALGER — Post Graduate Hospital — 2. Cataract extraction. Advancement operation.

Tuesday

DR. BELL — New York Eye and Ear Hospital — 2. Cataract extraction, Modified LaGrange for glaucoma.

DR. E. THOMSON — Manhattan Eye and Ear Hospital — 2. Cataract extraction. Trephine for retinal detachment.

DR. KNAPP.— Knapp Memorial Eye Hospital — 2. Intracapsular cataract extractions and operative clinic.

DR. SHEPHARD — New York Ophthalmic Hospital — 10. Stereoscopic exercises; training in binocular vision.

DR. HEALY — New York Ophthalmic Hospital — 11. Ophthalmoscopic clinic.

DR. MCLANE — New York Ophthalmic Hospital — 2. Monometric readings with aid of McLane's tonometer in human eyes.

DR. M. COHEN — Post Graduate Hospital — 2. Heisrath-Kuhnt operation for trachoma. Extirpation lacrymal sac.

DR. CUTLER — St. Luke's Hospital — 2. Ophthalmoscopic clinic.

DR. NOGUCHI — Rockefeller Institute — 11. Demonstration of specimens of bacteria in conjunctival diseases.

Wednesday

DR. DIXON — New York Eye and Ear Hospital — 11. X-ray localization of foreign body in eye and orbit. Exhibition of pathological eye specimens.

DR. LAMBERT — New York Eye and Ear Hospital — 2. Operation for congenital dislocation of lens and needing for high myopia.

DR. HELFRICH — New York Ophthalmic Hospital — 11. Ophthalmoscopic clinic.

DR. LLOYD — New York Ophthalmic Hospital — 11. Demonstration with lantern slides of campimeter. Cataract extraction, Smith method, intracapsular.

DR. HALLETT — New York Ophthalmic Hospital — 2. Intracapsular cataract extraction.

DR. DAVIS — Post Graduate Hospital — 2. Cataract extraction. Advancement operation.

DR. WIENER — St. Luke's Hospital — 2. Dacryo-cystorhinostomy, external method.

DR. KOLLER — Mt. Sinai Hospital — 2. Cataract extraction. Hotz's operation for glaucoma.

Thursday

DR. WEEKS — New York Eye and Ear Hospital — 2. Cataract extraction (La Grange). Lid plastic.

DR. WHEELER — New York Eye and Ear Hospital — 2. Cataract extraction. Extirpation of lacrymal sac.

DR. THOMSON — Manhattan Eye and Ear Hospital — 2. Cataract extraction. Elliot trephining.

DR. VAN FLEET — Manhattan Eye and Ear Hospital — 2. Cataract extraction. Advancement.

DR. KENNY — Manhattan Eye and Ear Hospital — 2. Cataract extraction.

DR. TYSON — Knapp Memorial Eye Hospital — 2. Cataract extraction. Ophthalmological clinic.

DR. TOROK — Knapp Memorial Eye Hospital — 2. Intracapsular cataract extraction. Lacrymal sac. Mueller's operation for retinal detachment.

DR. TRONCOSO — Post Graduate Hospital — 2.

DR. MEDING — Harlem Eye and Ear Hospital — 2. Intracapsular cataract extraction, Smith method. Elliot trephining for glaucoma.

Friday

DR. CALLAN — New York Eye and Ear Hospital — 2. Capsular cataract (DeWecker). Elliot trephining. Motais operation for ptosis.

DR. LAMBERT — New York Eye and Ear Hospital — 2. Ophthalmological clinic.

DR. MITTENDORF — Manhattan Eye and Ear Hospital — 2. Cataract extraction, Homer Smith method. Advancement. Enucleation with fat transplantation.

DR. HARE — Manhattan Eye and Ear Hospital — 2. Graduate tenotomy.

DR. WOOTTON — Manhattan Eye and Ear Hospital — 2. Ophthalmological clinic.

DR. MEEKER — Post Graduate Hospital — 2. Demonstration of pathological eye specimens.

DR. MAY — Bellevue Hospital — 2. Cataract extraction. Advancement, Lancaster method.

DR. WOLFF — Bellevue Hospital — 2. Enucleation with fat transplantation. Hotz operation for glaucoma.

LARYNGOLOGY

Monday

L. A. COFFIN — Manhattan Eye, Ear, and Throat Hospital — 2:30. Intranasal exenteration of ethmoidal cells with simultaneous cadaver demonstration.

A. M. ANDERSON — Polyclinic Hospital — 2. Frontal sinus and antral operation, intranasal; radiographic plates, demonstrating results after operation.

E. L. PRATT — Bellevue Hospital — 2. Submucous nasal resection. Exhibition of cases.

JOHN MCCOY — University and Bellevue Hospital Medical School — 2. Tonsillectomy and submucous nasal resection.

L. M. HURD — New York Throat and Nose Hospital — 2:30. Tonsillectomy and submucous resection.

JOHN LESHURE — Vanderbilt Clinic — 2. Tonsillectomy.

J. B. FERGUSON and J. L. MAYBAUM — Post Graduate Hospital — 12:30. Tonsillectomies, snare, Sluder and Beck-Muller methods.

Tuesday

H. L. LYNAH — Willard Parker Hospital — 9. Demonstration of direct intubation and extubation. Laryngeal cauterization for chronic stenosis of larynx. Bronchoscopy for removal of diphtheritic foreign body obstruction.

JOHN E. MACKENTY — Manhattan Eye, Ear, and Throat Hospital — 11. Laryngectomy.

E. R. FAULKER — Manhattan Eye, Ear and Throat Hospital — 9:30. Intranasal exenteration of ethmoidal cells under general anæsthesia.

J. J. KING — New York Eye and Ear Infirmary — 9:30. Tonsillectomy.

JOHN M. HALL — New York Eye and Ear Infirmary — 9:30. Tonsillectomy, cocaine anæsthesia.

L. M. HURD — Bellevue Hospital — 11. Intranasal operations on the nasal accessory sinuses.

J. D. KERNAN, JR.— Bellevue Hospital — 2:30. Nasal operations under local anæsthesia. Exhibition of cases.

J. E. MACKENTY — Manhattan Eye, Ear, and Throat Hospital — 3. Bone transplantation for nasal deformity.

J. H. ABRAHAM — Polyclinic Hospital — 2. Demonstration of nasal accessory sinus cases, with radiographic plates.

E. L. PRATT — Vanderbilt Clinic — 2. Tonsillectomy.

ARTHUR J. HUEY — University and Bellevue Hospital Medical College — 2. Submucous nasal resection.

W. W. CARTER — Gouverneur Hospital — 2. Bone transplantation for correction of nasal deformity.

B. DOUGLASS — Post Graduate Hospital — 12:30. Submucous resection of septum. Tonsillectomy by various methods. Nasal sinus surgery.

Wednesday

H. L. LYNAH — Polyclinic Hospital — 9. Demonstration of direct laryngoscopy and œsophagoscopy.

LEWIS A. COFFIN — Manhattan Eye, Ear, and Throat Hospital — 11. Operation for relief of ozena and presentation of cases.

N. R. DANN — New York Eye and Ear Infirmary — 9:30. Radical accessory nasal sinus operations.

C. G. COAKLEY — Bellevue Hospital — 2:30. External nasal accessory sinus operation.

J. D. KERNAN, JR.— Manhattan Eye, Ear, and Throat Hospital — 2. Operation for nasal deformity.

O. L. MONROE — Manhattan Eye, Ear, and Throat Hospital — 2. Tonsillectomy, local anæsthesia.

W. W. GRIFFIN — Manhattan Eye, Ear, and Throat Hospital — 2. Submucous nasal resection.

DRS. A. P. VOISLAWSKY, L. T. PERRAULT, and W. M. HUNT — St. Luke's Hospital — 2. Tonsillectomy, St. Luke's method, general and local anæsthesia, in cardiac and rheumatic patients in whom tonsil is focus of infection.

D. B. DELEVAN — St. Luke's Hospital — 2. Laryngectomy; end-results. Use of Dichloramine-T. Chlorcosane solution as used for disinfection of "carriers."

H. L. LYNAH — Polyclinic Hospital — 2. Bronchoscopy for thymic tracheal stenosis.

H. L. GATEWOOD — Polyclinic Hospital — 2:30. Tonsillectomy; new method of local anæsthesia.

M. D. LEDERMAN — Polyclinic Hospital — 3:30. Demonstration and treatment of lingual tonsil.

W. W. CARTER — Radium Sanatorium — 2. Bridge splint operation for correction of nasal deformity.

C. A. FRELIGH — Post Graduate Hospital — 12:30. Tonsillectomy. Submucous resection of septum.

Thursday

H. L. LYNAH — Willard Parker Hospital — 9. Demonstration of direct laryngoscopy, bronchoscopy, and œsophagoscopy; direct and digital method of intubation. Trachelotomy cases.

JOHN MCCOY — New York Eye and Ear Infirmary — 9:30. Laryngeal and nasal accessory sinus operations.

D. S. DOUGHERTY — Polyclinic Hospital — 10. Suspension laryngoscopy.

J. D. KERNAN, JR.— Bellevue Hospital — 2:30. Laryngostomy, tracheal stenosis. Suspension laryngoscopy.

J. E. MACKENTY — Manhattan Eye, Ear, and Throat Hospital — 2. Cleft palate operation.

J. A. MULHOLLAND — Manhattan Eye, Ear, and Throat Hospital — 2. Intranasal operation, nasal accessory sinuses.

WILLIAM M. DUNNING — Manhattan Eye, Ear, and Throat Hospital — 3. Submucous resection of nasal septum.

A. M. ANDERSON — Polyclinic Hospital — 2. Exhibition of sinus cases.

W. W. CARTER — Gouverneur Hospital — 2. Nose and throat operations.

B. DOUGLASS — Post Graduate Hospital — 12:30. Tonsillectomy under local anæsthesia. Bronchoscopy and œsophagoscopy.

Friday

E. V. HUBBARD — Manhattan Eye, Ear, and Throat Hospital — 11. Partial thyroidectomy (for goiter) with transplantation of remaining tube.

T. L. SAUNDERS — New York Eye and Ear Infirmary — 9:30. Radical nasal accessory sinus operation.

L. D. ALEXANDER — New York Eye and Ear Infirmary — 9:30. Intranasal antrum operation, cocaine anæsthesia.

L. M. HURD — Bellevue Hospital — 2:30. External accessory nasal sinus operation.

J. H. ABRAHAM — Polyclinic Hospital — 2. Tonsillectomy and method of ligation.

HARMON SMITH — Manhattan Eye, Ear, and Throat Hospital — 2. Tonsillectomy (Sluder).

I. W. VOORHEES — Manhattan Eye, Ear, and Throat Hospital — 2. Demonstration of the use of Dichloramine-T in infection of respiratory tract.

LEWIS A. COFFIN — Manhattan Eye, Ear, and Throat Hospital — 2:30. Nasal accessory sinus operations.

J. B. FERGUSON and J. L. MAYBAUM — Post Graduate Hospital — 12:30. Nasal sinus surgery, intranasal. Larynx examination, direct and indirect.

OTOLOGY

Monday

W. C. BOWERS — Bellevue Hospital — 2:30. Radical mastoid with skin grafting.

DR. KERRISON — Manhattan Eye, Ear and Throat Hospital — 2. Operative clinic.

DR. RICHARDS — Manhattan Eye, Ear and Throat Hospital — 3. Operative clinic.

DR. DWYER — Manhattan Eye, Ear and Throat Hospital — 2. Laboratory demonstration.

DRS. DENCH, PERKINS, ROBINSON and SCUTTER — New York Eye and Ear Infirmary — 2:30. Operations and demonstration of cases.

DR. SCHOOMAKER — Post Graduate Hospital — 2:30. Mastoid.

Tuesday

T. L. SAUNDERS — Bellevue Hospital — 2:30. Acute mastoid operation.

DR. PIKE — Manhattan Eye, Ear and Throat Hospital — 10. Experimental demonstration: Effect of certain lesions of the central nervous system on nystagmus.

DR. PHILLIPS — Manhattan Eye, Ear and Throat Hospital — 2. Operative clinic.

DR. SHARP — Manhattan Eye, Ear and Throat Hospital — 3. Operative clinic.

DR. LAW — Manhattan Eye, Ear and Throat Hospital — 3. Demonstration of cases.

DRS. DENCH, PERKINS, ROBINSON and SCUTTER — New York Eye and Ear Infirmary — 10:30. Operations and demonstrations.

DR. DIXON — New York Eye and Ear Infirmary — 10:30. Demonstration: Radiographs of mastoid cases.

DRS. BACON, SUTPHEN, and HALL — New York Eye and Ear Infirmary — 2:30. Operations and demonstrations of cases.

DR. MCFARLAND — Post Graduate Hospital — 2:30. Radical mastoid operation.

Wednesday

DR. SMITH — Polyclinic Hospital — 10. Demonstration on cadaver of radical and labyrinth operations.

DR. STEVENS — Polyclinic Hospital — 2. Radical operation.

DRS. FRIESNER and STRAUS — Manhattan Eye, Ear, and Throat Hospital — 10. Demonstration of neurological cases showing abnormalities of nystagmus.

DR. KERRISON — Manhattan Eye, Ear and Throat Hospital — 2. Operative clinic.

DR. PHILLIPS — Manhattan Eye, Ear and Throat Hospital — 3. Cinematographic demonstration of mastoid operation.

DR. WHITING — New York Eye and Ear Infirmary — 2:30. Operations and demonstrations.

DRS. LEWIS, BLACKWELL, FERGUSON and KING — New York Eye and Ear Infirmary — 2:30. Operations and demonstrations.

DR. FARR — Post Graduate Hospital — 2:30. Mastoid operation.

Thursday

DR. DENCH — St. Luke's Hospital — 2:30. Radical operation for chronic middle ear suppuration.

DR. BOWERS — St. Luke's Hospital — 2:30. Complete mastoid operation.

DR. PERKINS — St. Luke's Hospital — 10. Ward demonstration.

DR. DWYER — Manhattan Eye, Ear and Throat Hospital — 10. Laboratory demonstration.

DR. BRAUN — Manhattan Eye, Ear and Throat Hospital — 2. Operative clinic.

DRS. DWYER and FRIESNER — Manhattan Eye, Ear and Throat Hospital — 3:30. Demonstration: Radical mastoid operation on cadaver.

DRS. LEWIS, BLACKWELL, FERGUSON, and KING — New York Eye and Ear Infirmary — 10:30. Otorhinological clinic.

DR. DIXON — New York Eye and Ear Infirmary — 10:30. Demonstration: Radiographs of the mastoid.

DR. MCCOY — New York Eye and Ear Infirmary — 2:30. Operations and demonstrations.

DR. O'CONNELL — Post Graduate Hospital — 2:30. Radical mastoid operation.

Friday

DR. DAVIS — Polyclinic Hospital — 10. Demonstration of labyrinth tests.

DR. SMITH — Polyclinic Hospital — 2. Demonstration of ten postoperative mastoid (radical) cases.

DR. HURD — Bellevue Hospital — 2:30.

DR. LAW — Manhattan Eye, Ear and Throat Hospital — 10. Lantern slide demonstration of X-rays of mastoid and sinus.

DR. MCFARLAND — Manhattan Eye, Ear, and Throat Hospital — 2. Operative clinic.

DR. PAGE — Manhattan Eye, Ear, and Throat Hospital — 3:30. Operative clinic.

DRS. SAUNDERS and A. U. CALLISEN — New York Eye and Ear Infirmary — 2:30. Operations and demonstrations.

DR. SMITH — Post Graduate Hospital — 2:30. Mastoid demonstration.

DR. BROWN — Post Graduate Hospital — 3:30. Cochlear and vestibular tests in connection with malingering.

PRELIMINARY SCHEDULE OF CLINICS IN BROOKLYN

GENERAL SURGERY, ORTHOPEDICS AND UROLOGY

Monday

R. S. Fowler and A. H. Bogart — Methodist Episcopal Hospital — 9.
W. F. Campbell (or J. S. Wight) — Long Island College Hospital — 9.
J. M. Downey — Holy Family Hospital — 9:30.
William and John Linder — Jewish Hospital — 9.
J. B. Bogart and G. I. Miller — Jewish Hospital — 2.
H. C. Fett — Long Island College Hospital — 8.
N. P. Rathbun — Brooklyn Hospital — 9.

Tuesday

R. W. Westbrook and H. F. McChesney — Brooklyn Hospital — 9.
W. Pascual — Holy Family Hospital — 9:30.
J. B. Bogart — Kings County Hospital — 9.
H. F. Graham and C. H. Goodrich — Methodist Episcopal Hospital — 9.
W. Truslow — Brooklyn Hospital — 2.
H. E. Fraser — Kings County Hospital — 2.

Wednesday

W. F. Campbell — Long Island College Hospital — 2.
R. S. Fowler and G. H. Bogart — Methodist Episcopal Hospital — 9.
William and John Linder — Jewish Hospital — 9.
J. M. Downey — Holy Family Hospital — 9:30.
J. B. Bogart and G. I. Miller — Jewish Hospital — 2.
N. P. Rathbun — Brooklyn Hospital — 9.

Thursday

R. W. Westbrook and H. F. McChesney — Brooklyn Hospital — 9.
J. B. Bogart — Kings County Hospital — 9.
H. F. Graham and C. H. Goodrich — Methodist Episcopal Hospital — 9.
H. H. Morton — Long Island College Hospital — 3.

Friday

R. S. Fowler and A. H. Bogart — Methodist Episcopal Hospital — 9.
William and John Linder — Jewish Hospital — 9.
J. B. Bogart and G. I. Miller — Jewish Hospital — 2.
J. S. Wight — Long Island College Hospital — 9.
H. C. Fett — Long Island College Hospital — 8.
N. P. Rathbun — Brooklyn Hospital — 9.

GYNECOLOGY

Monday

C. A. Gordon — St. Catherine's Hospital — 8:30.

Tuesday

C. S. Hyde and W. P. Pool — Long Island College Hospital — 8.
H. A. Wade — Bethany Deaconess Hospital — 10.
V. A. Robertson — Coney Island Hospital — 9.
V. L. Zimmerman — Holy Family Hospital — 9.
A. M. Judd and A. Bonner — Jewish Hospital — 9.
V. L. Zimmerman — St. Mary's Hospital — 9.
O. P. Humpstone — Methodist Episcopal Hospital — 9.
J. P. Glynn — Williamsburg Hospital — 9.
J. O. Polak and L. Schwartz — Jewish Hospital — 2.

Wednesday

L. G. Baldwin — Skene Sanitarium — 8:30.
R. M. Beach — Methodist Episcopal Hospital — 9.
R. H. Pomeroy — Brooklyn Hospital — 9.
F. Weisbrod — German Hospital — 8.
W. A. Jewett — Bushwick Hospital — 9.
H. A. Wade — Williamsburg Hospital — 10.

Thursday

V. A. Robertson — Coney Island Hospital — 9.
F. C. Holden — Greenpoint Hospital — 9 and 2.
V. L. Zimmerman — Holy Family Hospital — 9.
J. P. Glynn — Williamsburg Hospital — 9.
C. A. Gordon — St. Catherine's Hospital — 8:30.
V. L. Zimmerman — St. Mary's Hospital — 9.
J. O. Polak and L. Schwartz — Jewish Hospital — 2.
O. P. Humpstone — Methodist Episcopal Hospital — 9.
A. Bonner — Jewish Hospital — 9.
J. O. Polak — Long Island College Hospital — 8.

Friday

R. H. Pomeroy — Brooklyn Hospital — 9.
W. A. Jewett — Bushwick Hospital — 9.
S. J. McNamara — Kings County Hospital — 9.
L. G. Baldwin — Skene Sanitarium — 8:30.

SURGERY OF THE EYE, EAR, NOSE AND THROAT

Monday

C. G. Crane and W. S. Shattuck — Brooklyn Hospital — 9. Ear, nose and throat.
P. H. Sturgis — Methodist Episcopal Hospital — 2. Nose and throat.

Tuesday

A. M. Howe and A. Hayman — Jewish Hospital — 2. Ear, nose and throat.
A. J. Keenan — Long Island College Hospital. Nose and throat.
H. M. Smith — Long Island College Hospital. Eye.

Wednesday

P. H. Sturgis — Methodist Episcopal Hospital — 2. Nose and throat.

Thursday

C. G. Crane and W. S. Shattuck — Brooklyn Hospital — 2. Nose and throat.

Friday

P. H. Sturgis — Methodist Episcopal Hospital — 2. Nose and throat.
A. M. Howe and A. Hayman — Jewish Hospital — 2. Nose and throat.